



A PLACE OF INGENUITY

Peter G. Gil



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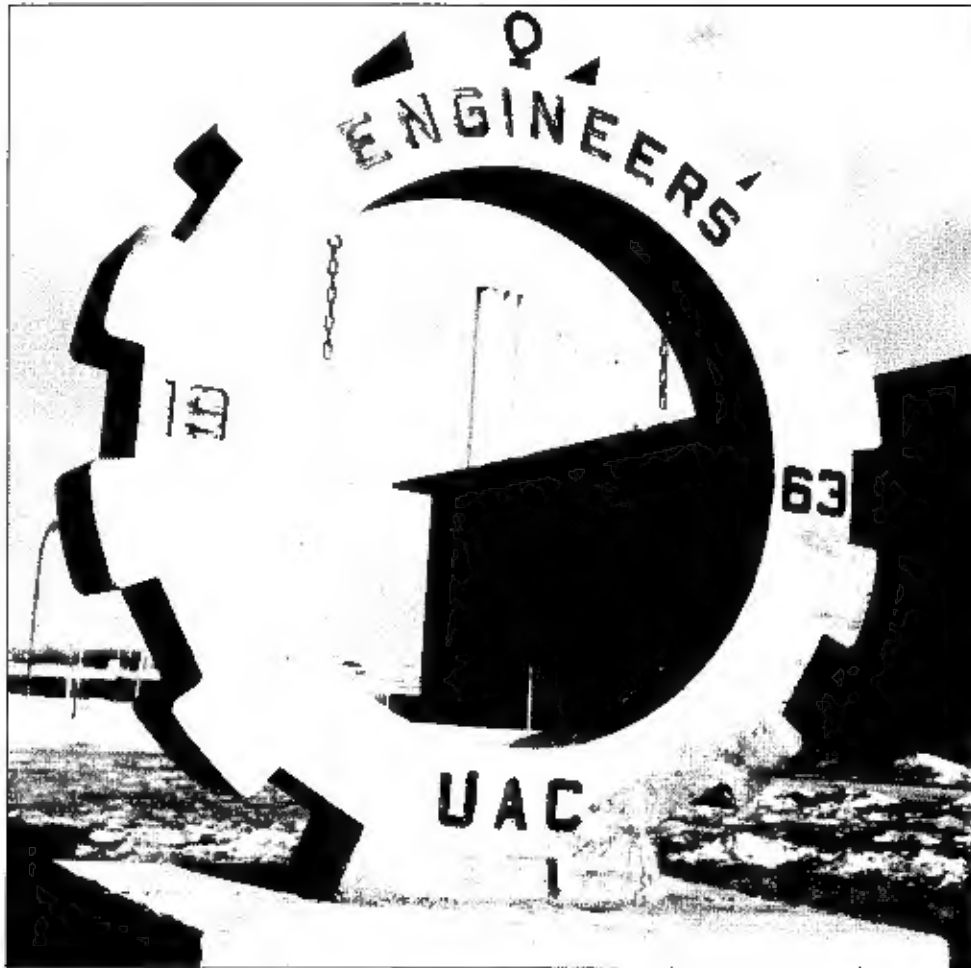
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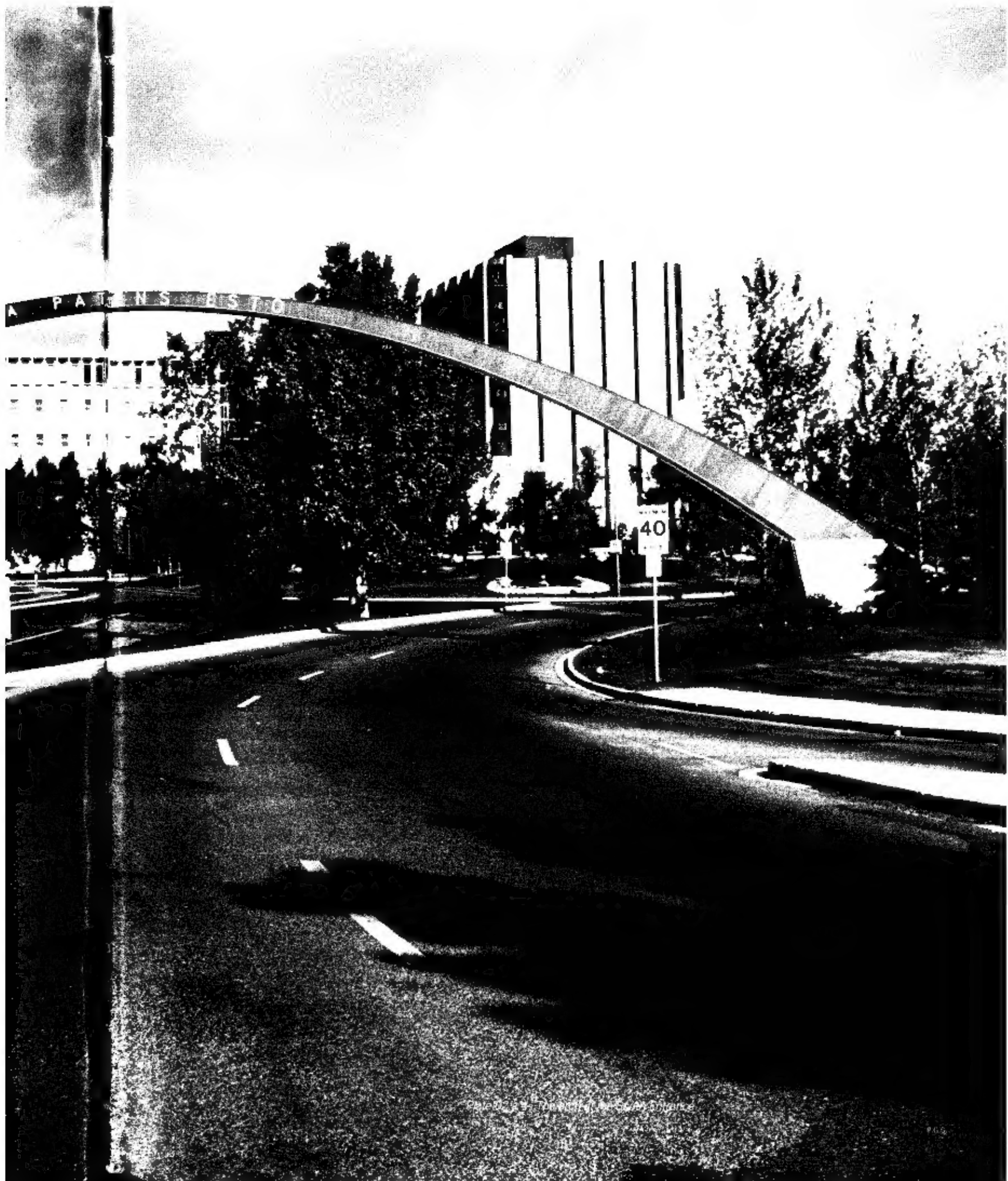
John G. Thompson



H.A.R. dePaiva

Plate 0.1 — The Cogwheel
(see Chapter I)







P.G.G.

Plate 0.2b — The arch at the South Entrance to the campus is seen with Dr. Robert E. Loov, one of the originators of the structure - Sept. 1991.

PORTA PATENS ESTO ! — LET THIS GATE STAND OPEN !

(A mediaeval phrase associated with the Abbey of Asello in Italy).

The arches were originally designed as the main structural members of the **Rainbow Bridge** (see Plate 2.45), built in 1966. They were suggested by Professors R.E. Loov and B.B. Hope, Dept. of Civil Engineering, as an aesthetic alternative to the design proposed by the consultants. In 1985, the bridge became part of the landswap agreement between the City and The U of C in connection with the construction of the northwest leg of the L.R.T. system. After the University LRT Station was completed, the bridge was dismantled during the first week of July 1986 and the arches transported to the south entrance of the campus on University Drive. There they were reassembled into the university's gateway structure seen in the photograph (Plate 0.2). The arches were repainted a metallic bronze.

Relocation of the arches and the unveiling of the new south entrance sign, a flamingo quartz pre-cast concrete panel with dark bronze lettering and centred in the grass boulevard, were commemorated by a brief ceremony on Thursday, Sept. 25, 1986, with the following university officials participating: Dr. Brian S. Norford, Chancellor; Mr. Robert A. Willson, Chairman of the Board of Governors; Dr. Norman E. Wagner, President; Dr. E. Brian Tinker, Vice-President (Finance & Services) and Master of Ceremonies; Dr. Robert E. Loov, Head, Dept. of Civil Engineering. A time capsule was inserted into the East Abutment to be opened after 100 years, in the year 2086.

THE UNIVERSITY OF CALGARY

A Place of
Ingenuity

THE FACULTY OF ENGINEERING

Peter G. Glockner





Photo courtesy of Calgary Herald

*Plate 0.3 — On the morning of Monday, April 4, 1988, campus police noticed a red Honda Civic automobile suspended from the apex of the gateway arch at the University Drive campus entrance. It was hanging some 10 metres above the road surface, held by means of a nylon sling and displayed the inscriptions: **HRC, Free Parking, and Arch Angel**. This prank was allegedly carried out by a group of engineering students, referred to as the **Hell Raising Committee, HRC**, sometime during the preceeding night. The photograph was taken while the car was being removed from the arch.*

The Faculty of Engineering
The University of Calgary
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Dedication

This book is dedicated to:

- *The Calgary University Committee for being a most vigorous and relentless force in bringing university education to their city*
- *Dean R. H. Hardy for helping to initiate Engineering in Calgary.*
- *Profs. H. R. MacArthur and W. H. Sullivan for starting the foundation*
- *Dr. G. W. Govier for drawing up the blueprint*
- *Dr. A. M. Neville for being the catalyst in the realization of the blueprint*
- *All persons who through their work and dedication helped to build this Faculty*



Pea

Plate 0.4 — The sculptured look of the west facade of the E-Lecture Theatres - Jan. 23, 1992.

ETYMOLOGY

OF THE WORD

ENGINEER

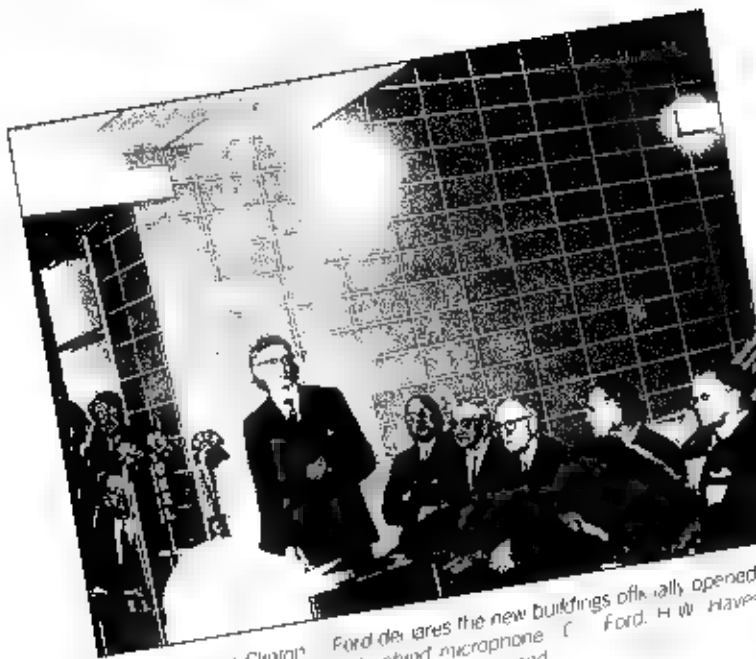
Unlike in present day English, where the term engineer appears to be related to the word **engine**, in most European languages the first four letters of the word engineer are **inge** or symbols representing sounds which correspond to these four letters of the Latin alphabet. Interestingly, the Oxford English Dictionary* shows the Old-English or obsolete forms of these expressions as **ingenier*** (-ner, -neer) and **ingene***. What are the roots of these words?

In French, the word **ingenieur** is derived from **ingenieux** which comes from the Latin **ingeniosus**, meaning skillful, dexterous, handy, clever, talented, artistic and, of course, ingenious. The corresponding Latin noun **ingenium** is the root of ingenuity and means, amongst others, inborn natural talent and ability, perspicacity, inventiveness, imagination, mental prowess.

Thus the word **engineer**, or **ingenieur**, a word first used in the early 14th Century, refers to a person who is ingenious, inventive and apt in doing things and solving problems. Our Faculty of Engineering, as any engineering school is, therefore, by definition, **a place of ingenuity**

The word **engine** is likely derived from and is an abbreviation of the expression ingenious device, a name applied to any clever implement or invention before the term machine or engine was in common use.

*2nd Ed., 1989 5, pp. 250-252 7, pp. 956-958 and 20, pp. 753



a Chief Justice Clinton Ford declares the new buildings officially opened to R. M. G. Taylor seated behind microphone. C. Ford, H. W. Hayes, Hartley, Cairns, W. H. Johns, G. P. MacLeod



b The Principal, Dr. Malcolm G. Taylor is closing the ceremonies by thanking the City of Calgary, the Province and the people of Alberta for the new facilities. C. to R.: Ford, H. W. Hayes, Hartley, Cairns, W. H. Johns and G. P. MacLeod



c Official opening of the new facilities is symbolized by cutting of the ribbon by Chief Justice Clinton Ford assisted by President Walter H. Johns. C. and the Chairman of the Board of Governors, C. M. MacLeod

Plate Q F The opening ceremonies for the first two buildings on the new campus of the University of Alberta, Calgary UAC were held under the chairmanship of the President Dr. Walter H. Johns at 3:00 PM on Friday, Oct. 28, 1960 on the main floor of the North Tower Arts & Education Building (renamed the Administration Building). Other members of the official party included the Chief Justice of Alberta Clinton Ford who on behalf of the Premier and the government performed the official opening of the facilities, the Honourable James Hartley, Minister of Public Works, who made the presentation of buildings, the Chancellor of the University of Alberta Justice J. Y. Cairns, the Chairman of the Board of Governors, Dr. M. MacLeod, who accepted the buildings and the site on behalf of the university, his Worship the Mayor of Calgary Mr. Harry W. Hayes who made the presentation of site on behalf of the City, the Reverend Dr. G. P. MacLeod of Knox United Church, who gave the invocation, and the Principal of UAC Dr. Malcolm G. Taylor who gave the closing remarks and described the use of the buildings. The ceremonies were followed by tours of the facilities arranged by the students and by a reception in the library on the lower floor planned by the Faculty Women's Club. Fall Convocation was held next day on Saturday Oct. 29 in the Jubilee Auditorium a highlight of which was the installation of the Principal. Photographs courtesy Dr. Ethel King-Shaw.

INTRODUCTION

Passage of the Universities Act by the Alberta Legislature established The University of Calgary as an autonomous institution, effective April 1, 1966. The University's official *Silver Anniversary* year therefore was 1991 which was celebrated through a series of special programmes, events and activities, including the publication of an anniversary volume.

The Faculty of Engineering joined in on the celebration with its own programmes such as the *25th Anniversary Celebration of Excellence Guest Lecture and Seminar Series* and the presentation of *25th Anniversary Faculty of Engineering Certificates of Excellence* to students, alumni and staff in recognition of outstanding performance, achievements or contributions. In addition and at the initiative of the Faculty's 25th Anniversary Committee, a decision was taken during the Fall '90 term to produce an anniversary publication. The writer was invited to take on responsibility for this project.

This book presents highlights of the history of the Faculty of Engineering at Calgary for the period 1957-1991 with 1992-93 events considered for inclusion only where the affected chapter and text was not finalized prior to their occurrence. It contains seven chapters and thirteen appendices, Appendices A-N. The book was started by writing Chapter I, a brief description about the evolution of the cogwheel as the faculty symbol. Chapter I was tackled next with focus on events significant to the Faculty as a whole. This *Faculty chapter* contains eight sections, including an epilogue, with more pages of text, figures and plates than any other chapter in the book. Furthermore, detailed treatment of certain of its topics takes up four of the thirteen appendices, Appendices A-D.

Next to be composed was Chapter VII which deals with Surveying Engineering, renamed Geomatics Engineering after completion of the chapter. It is the shortest of the departmental chapters, containing only 2 sections, due to the fact that the surveying engineering programme was started in 1979, some twelve years after the departmental curricula were inaugurated. The remaining four departmental chapters, each containing three sections, were written thereafter in the following sequence: Chapter V - Electrical and Computer Engineering; Chapter V - Civil Engineering; Chapter II - Chemical and Petroleum Engineering; and Chapter VI - Mechanical Engineering. Each of the departmental chapters has a single appendix associated with it and each of them, as well as the faculty chapter, has an opening *Silver Anniversary Section* in which the reader is introduced to the unit in question as it existed and operated in 1990-91.

From the outset, the book was intended to focus on events and activities involving students and staff with an emphasis on excellence. As a result, it has a number of features not usually found in this type of publication, including the following:

From the outset, the book was intended to focus on events and activities involving students and staff with an emphasis on excellence. As a result, it has a number of features not usually found in this type of publication, including the following:

- a complete list of graduates from the Faculty of Engineering, 1965-1993, Appendix N,
- lists of engineering academic and support staff, 1957-1992²
- lists of major external undergraduate and graduate scholarship, prize and award winners, 1965-1992, Tables 3.3 - 7.3,
- lists of major achievements by and awards to academics, 1960-1992.

It was also decided to make generous use of colored bar chart figures and photographs to *amplify* the text. *Generous use* was interpreted to

mean at least two such *amplifiers* per regular text page, a rule which became one of the project's major challenges and a controlling factor in determining the number of possible pages for a section. Photographs were carefully screened as to their suitability, rejecting those which depicted equipment without any persons or on which at least one individual could not be identified.³ As a result of these guidelines, the book is enriched through 43 figures and over 410 plates containing more than 650 individual photographs, nearly 270 of which are portraits of students, staff and administrators. Significant also is the fact that to each photograph there is a caption which in some cases is fairly lengthy, telling a whole story.

Another feature of the book results from the fact that it treats the first 36 years of the Faculty's history, including the early years of rapid development. Those initial periods of explosive growth are full of exciting events and numerous and frequent *firsts*, the chronicling of which takes up and is allotted more space than the description of subsequent periods. For example, to indicate the rapid growth in undergraduate and graduate enrolments and research, student numbers and names of graduate students and graduate degree recipients are detailed for the first few years of the departmental histories. External research funding, developing research areas and major research projects are described for those years and photographs of the first graduating classes and where available, portraits of the first graduate degree recipients for each degree category, are also included. Throughout the volume and where possible, precise information is given in preference to approximate or generalized statements thereby often also saving space. An attempt was made to avoid

¹ Bott, R. and Ooms, R.: *A Place of Vision*, The U of C Press, 1990, pp. 11.

² All full-time academic appointees and all support staff with a minimum service period of a year are listed in Tables 2.4 - 7.4. Names of some long serving sessional and visiting academic staff are also included.

³ The rule was relaxed in a few cases.

duplication. However, for the sake of continuity and completeness of a section, certain details may be repeated or expanded. Also, it was recognized that readers may have an interest in a particular chapter which they will consult before studying other segments of the book. It was, therefore, desirable to make chapters and sections reasonably self-contained.

The project was proposed as a 50 page spiral bound booklet to be completed within a few months. That proposal evolved into this anniversary volume with more than 300 pages that took over 3 years to write. It contains a wealth of information and yet, some topics of interest had to be omitted because of time constraints and size limitations. For example, budgetary matters, including operating and capital budget figures for the Faculty and the departments, are not treated. Neither are departmental programmes and programme developments discussed in any detail. Regrettably, an originally proposed chapter on student activities also had to be eliminated. Instead, student highlights are woven into the departmental and Faculty chapters thereby enlivening the narratives. In addition, prizes and awards won by undergraduate and graduate students as well as staff achievements are summarized in tables at the end of each departmental chapter.

Persons are referred to by their full name and title where they are introduced. In subsequent descriptions, surname with or without title or with first name may be used. Names of organizations and agencies are written out without abbreviations where they first appear. In subsequent occurrences, abbreviations may be applied to save space, the reason also for using numerals in the text for all numbers, including the first nine. An exception was made in this Introduction and in the Postscript. Space limitation was one of the main factors also for not using sub-headings in the Sections where the text is interspersed with numerous photographs and figures.

For convenience, frequently used terms and abbreviations are summarized in a *Glossary* in Appendix K. Also for convenience of the reader, a *monetary value indicator*, based on 1992-93 prices, wages and salaries, is provided in Appendix L. Highlighting or emphasizing certain words, phrases or names within the text is accomplished by means of italicizing. Within captions, where the text is in italic, special bold font is used for highlighting. Quotation is indicated throughout the book by means of single quotation marks.

The book is based on historical data obtained from a number of sources. Thus, the length of each section in each chapter is a direct indicator of the amount of material, including photographs, which was available to the writer at the time of composition of that particular segment of the book. Main sources for information and photographs included the publications of the Office of Institutional Analysis, OIA, the University Archives, the Faculty Archives, the Faculty Drafting and Photography Centre, the Photographic Section of the Department of Communications Media, minutes of meetings of Engineering Faculty Council, EFC, the Faculty's annual reports, minutes of departmental council meetings, departmental annual reports, records of the Engineering Students' Society, ESS, and the office of the Director of Academic Administration. While writing Chapter VII, the Department of Surveying Engineering made available its own extensive photographic collection of special events. Excellent collections of photographs were also obtained from private collections of individuals, including former and present students and staff in the various units of the Faculty and former members of the university community.

The help the writer received throughout the project from friends and colleagues in gathering data and photographs is detailed in the Acknowledgements near the end of the book where a complete listing of all figures and plates is also given.

Writing this book was a unique challenge. Above all, it was a continuous learning experience, quite different from writing a paper or a research monograph in one's specialty. Much of the time the subject matter was unfamiliar to the writer and as simple a task as composing an appropriate caption for a photograph could turn into a major obstacle, requiring help from the experts. It was also an exercise in creativity where composing and finally settling on a suitable section title could take days or weeks.

Producing the volume also meant getting immersed in the technical details of producing a book, including font style and size, page layout, design of cover and title page and experiencing the frustration of the seemingly interminable rewrites required to mold text and pictures for every section into a harmonious unit and to make it fit within the planned page limit. Most importantly, however, the project provided an opportunity to meet every academic and support staff member in Engineering. While personally shooting, and reliving the many photographs appearing in the seven Silver Anniversary Sections and throughout the book, the writer visited with old friends and became acquainted with new colleagues. While doing so he gained a glimpse of the wide spectrum of high calibre fundamental and applied research being carried out in the Faculty of Engineering, a most impressive activity which is continuously being recognized by national and international prizes and awards and which helped to attract external research funding in the order of \$8.5 million during 1993.

The book, however, would not have been completed without the continuous support and encouragement of my wife, Sarah, who showed infinite patience when project material seemed to inundate every segment of the house. We are both extremely happy to see the book in print.

February 1994

Peter Glockner

FACULTY CHRONOLOGY

1951 The Calgary University Committee (CUC) sponsored a public meeting on May 2 urging the Board of Governors of the U of A to expand programme offerings at the Calgary Branch, including the introduction of the 1st year of the engineering programme.

1955 A delegation of the CUC consisting of Mrs. H.T. Robertson, Mr. P.P.C. Hagh and Alderman Grant McEwan attended the Board meeting in Edmonton June 3 and presented a submission recommending the immediate systematic and progressive expansion of University facilities and programmes in Calgary including the first year in Engineering.

1956 Engineering Faculty Council (EFC) at its meeting on March 19 discussed the matter of offering the first year of the programme in Calgary. Dean R.M. Hardy stated that start up would not be feasible in the Fall of 1956.

At the Oct. 16th meeting of EFC, Dean Hardy announced that a recommendation is going to the Board that the first year of the Engineering programme be offered at the Calgary Branch, commencing in Sept. 1957 with the number of students restricted to 60.

1957 The first year engineering programme is started at the SALT campus in September with 59 students and 2 engineering staff members. Messrs. H.R. McArthur and W.H. Stowe.

1959 Dean R.M. Hardy resigns to be succeeded by Dr. G.W. Govier.

1960 The University of Alberta Calgary JAC moved to the new present campus. Dr. M.G. Taylor appointed Principal of LAC. Engineering programme offerings are expanded to include the 2nd year. Staff increased by transferring 3 academics from Edmonton to Calgary. H.R. McArthur appointed Secretary of the Faculty.

1961 Dean George W. Govier submitted his Long Term Development Plan which contained the blue print for this Faculty.

1963 G.W. Govier resigns to be succeeded by R.M. Hardy.

The Calgary operation of the Faculty of Engineering becomes the Division of Engineering with departmental status and with a Chairman as its executive officer. Dr. Adam M. Neville appointed Chairman of the Division July 1.



Photo courtesy of A. Armstrong

Plate 1 of "Prof. R.M. Hardy, Dean of Engineering at the U of A, 1956-1963-1971"

Graduate programme initiated with 5 MSc students in Civil Engineering Construction of the first Engineering Building on the Calgary Campus. E Block started in November.

1964 Dr. H.S. Armstrong appointed first president of the University of Alberta, Calgary (July 1).

Engineering Council formed with first meeting on Sept. 28, 1964. Curriculum Committees for 1st and 2nd year of new engineering programme established.

E Block officially opened on Nov. 25, 1964.

Course outlines and details for 1st and 2nd year programmes approved.

1965 Faculty status achieved on April 1. A.M. Neville appointed first Dean of the Faculty in Calgary with H.A.R. dePaiva as Administrative Assistant and M. Christopherson first Dean's Secretary. Rod dePaiva becomes the first Assistant Dean Nov. 1.

First meeting of Engineering Faculty Council held April 26 at which the Post-Graduate



Plate 2. Members of the first Engineering Students' Society Executive 1957-58. L to R: Fred Messina (Vice-President), Eugene Mikosky (President) and Richard King (Secretary). Treasurer: Roger Johnson. Student Council Representative not shown.



Plate 08 Three academics from Electrical Engineering are cornering one in the Engineering Queen Centre. Judges Gordon Moore (left), Chemical Engineering and R. Len Bruton (right), Gordon Moore, Jim Haseeth and George Williams (right) are shown in a group photo. April 1, 1972-73

Diploma in Engineering programme is approved

The MSc students who began the programme in Sept. 1963 become the Faculty's first graduates

The 1st year of the new engineering curriculum is started in September

Construction on D and C Blocks and the E Lecture Theatre Wing started during the summer

Curriculum committees for the 3rd and 4th year programmes in Chemical, Civil and Mechanical Engineering and the common core established and their recommendations approved by EFC in December

1966 The Universities Act passed and The University of Calgary established as autonomous institution April 1

Departments of Chemical, Civil, Electrical and Mechanical Engineering established on July 1 with Department Heads in Chemical and Mechanical Engineering appointed

The position of Head of Common Curriculum as well as 6 Inter-Departmental Committees (IDC's) established

D and C Blocks and E Lecture Theatre Wing completed. Construction on B Block and Energy Transfer Laboratory (ETL) started

The 2nd year of new curriculum implemented

The MEng programme and degree approved by EFC

Electrical Engineering departmental curriculum approved

Petroleum Recovery Research Institute (PRR) established and housed on 3rd floor of D Block. Dr. N. Mungan appointed its first Head

1967 First Heads appointed in Civil and Electrical Engineering

First and 2nd year programmes reviewed and revised

Third year of new curriculum implemented in all four departments

B Block and ETL completed and occupied. Construction on A-Block started

Engineering Library Reading Room established

First PhD graduate from Faculty at Fall Convocation (M.A. Sheikh CE)

1968 A.M. Nevie resigns to be succeeded by Dr. R.A. Ritter

Head of Common Curriculum appointed

The degree designation with distinction approved by EFC

Centennial Sculpture presentation by the EIC Wives Club of Calgary (May 27) serves as unofficial opening of the Engineering Complex with A Block nearing completion

First and 2nd year programme revised again

The 4th year of the new curriculum implemented in September

1969 First BSc graduating class at Spring convocation

First Post Graduate Diplomas in Engineering awarded

The 15 week terms in 2nd, 3rd and 4th year engineering courses reduced to 13 weeks

First University Industry seminar arranged by Mechanical Engineering

The U of C Explosives and High Pressure Research Laboratory is established on and leased from Canadian Industries Ltd. in Ogden, S.E. Calgary spearheaded by Dr. T.K. Groves



Plate 09 William George Howard, BSc '73 Civil Engineering, was President of the Engineering Students' Society. He was a bright engineer with leadership qualities, a good sense of humour, an ability to motivate others and a vast interest in the welfare of his fellow human beings. After graduation he joined Canadian University Services Overseas and went on an assignment to Malaysia where he was killed in a traffic accident near Ayer Star in August 1975. The W.G. (Bill) Howard Memorial Foundation was established in 1977 by his peers as a volunteer group of former members of the Calgary professional business, legal and educational communities to honor Bill's memory and to promote and recognize the ideals he stood for including leadership, motivation, communication, integrity, achievement, and care for others. The Foundation manages an endowment which provides two awards annually to engineering students who best personify these characteristics.



Plate 0.10 Members of the Omnipotent Queen Week Committee (OQWC) are shown after judging the ice sculptures during Engineering Week. L to R: Michael A. Goy, Peter F. Williams, President Murray Fraser, A. James Hume, Dean Len T. Butler, Steven A. Odell, Mrs. Pamela Parr, Student Affairs, Mrs. Donna Geeke, Dean Office. Jan/Feb. 1989

1970 First female BSc graduate in Engineering Miss B. J. Mathiesen ME

First MEng degrees awarded at Fall Convocation

Courtyard fountain R. Ritter's fountain, finished during summer

1971 Seventy-five minute lectures for Tuesdays and Thursdays approved

Student evaluations introduced

Third Canadian Congress of Applied Mechanics hosted by the Faculty and The U of C

Dean's list instituted

1974 R. A. Ritter resigns

1975 SI system of units introduced

Dr. T. H. Barton appointed Dean on July 1

First year class size leads to establishment of enrolment limit of 450 with visa student numbers set at 50

Government institutes freeze on all new capital construction

1976 Major curriculum review initiated

Course work only MEng programme suggested

1977 Letter of Intent for BSc in Surveying Engineering approved

Dr. D. W. Bennion appointed first AOSTRA Professor at The U of C Jan. 1

The Computer Modeling Group established with Dr. K. Aziz as first Director

Major changes in curriculum approved necessitating rev

sions to departmental programmes

1978 First year enrolment limit increased to 400; second year quota established at 350

Five of seven DC's disbanded at June EFC meeting

Revised 1st year programme implemented

1979 Surveying Engineering programme and Civil Engineering Building Extension approved by government. Division of Surveying Engineering established in Civil Engineering with Dr. E. J. Krakowsky appointed its first Chairman

The third year surveying engineering programme implemented in September

The second year of the revised curriculum implemented

The Petroleum Research Recovery Institute vacates 3rd floor of D-Block and moves to the University Research Park

The University Food Services constructs an outlet at the south end of the Student Lounge

1980 The revised departmental curricula are being phased in

A name change from *Chemical* to *Chemical and Petroleum Engineering* is approved



Plate 0.11 Mr. Paul Laviole, supervisor of the Faculty of Engineering Machine Shop staff, is finishing the steel hand railing around the deck on the north side of the Main Brace Support Staff Lounge. The railing, prefabricated in 3 sections in the Machine Shop, was assembled and welded together on site. June 1991

The course-work on y MEng programme approved

Construction of F-Wing (the New Civil Engineering Building) started

Courses in Project Management initiated by Civil Engineering

- 1981 Implementation of revised 3rd and 4th year programmes completed

Chair in Petroleum Engineering approved and fund raising initiated

Computer Engineering Minor introduced by Electrical Engineering

- 1982 Fund raising for petroleum Engineering Chair completed

Dr Eric L. Toilefson appointed AOSTRA Professor July 1

- 1983 First graduates from Computer Engineering Minor

Petroleum Engineering Chair holder appointed (Dr R M Butler)

Project Management courses initiated in Civil Engineering with W E Allen as instructor

- 1984 Project Management innovative Project funded by Advanced Education and operated in Civil Engineering under the direction of Mr W E Allen

- 1985 T H Barton succeeds by Dr L T Bruton

Dr H A R de Paiva appointed Director of the Project Management Programme, offered jointly by the Faculties of Engineering and Management

- 1986 The Division of Surveying Engineering granted departmental status.

- 1988 A 5-year double major BSc, BA programme, offered jointly by the Faculties of Engineering and Humanities introduced

- 1989 International MEng programme introduced

Minor in Computer Integrated Manufacturing introduced by Mechanical Engineering

- 1990 Name change from *Electrical* to *Electrical and Computer Engineering* approved



Plate 0.12 One half of The U of C delegation to the 1992 National Conference of the Canadian Federation of Engineering Students, held in Montreal. L to R: Rowena Platon, Cheryl Anderson, rear: Kristine Cadman, Josée Tremblay, Jan 12 1992

First BSc graduates from C M Minor in Mechanical Engineering

L T Bruton is succeeded by Dr E Rhodes

Division of Manufacturing Engineering established within Mechanical Engineering with Dr D H Norrie as its first Head

- 1991 The Petro Canada Building leased for a 10 year period by the University. The building is assigned to Mechanical Engineering. Department vacates B Block and moves into its new home during the summer of 1991.

- 1993 E (Ted) Rhodes resigns Dec 31



Plate 0.13 Engineering Students Society Executive 1991-92. L to R: Steve Giacomini, Keith Scott, Siade Thornhill, Morgan Rodwell, Aislinn Haneen, Johnny Hedge, Dave Lee (front), Ray Predika (partly visible), Dushan Arumagan, Cheryl Anderson. Palliser Hotel, March 17 1992

A Place of *Ingenuity*

I.

THE WHEEL

THE COGWHEEL

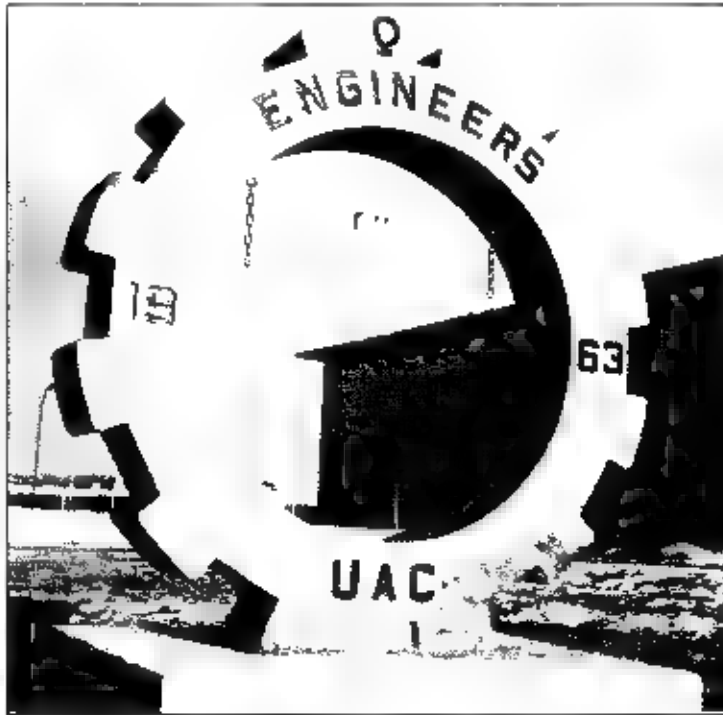


Plate 1.1 THE WHEEL

Sometime during the Fall of 1963 our engineering students constructed a reinforced concrete cogwheel to be used in promoting the University's drive towards independence (see Plate 1.1). The wheel was cast in the engineering laboratories of the Science and Engineering Building (now Science A) with assistance in design and construction provided by faculty members including H.A.R. dePaiva and R.E. Loov. To facilitate handling the base and the wheel were cast as separate elements and connected by means of bolts.

When completed and assembled in front of the Library (the current Library Block) it was ceremoniously unveiled by members of the Engineering Students Society (ESS) Executive one lunch hour in December



Plate 1.2 UNVEILING THE WHEEL

Jack Blair (L) and Mark Burggren (R), Social Director and Treasurer of ESS respectively performing the honourous task. Likely on December 20, 1963, the day after Dr. M.G. Tavini's resignation became known, a day referred to by the students as **autonomy day**. Otto Szentesi, ESS President (not shown) was presiding.

1. The main features of this story were provided to the writer in a written communication by Dr. H.A.R. dePaiva during the Winter Session of 1991 entitled 'Story of the Cogwheel' with which he also provided the color slide for Plate 1.1.



Plate 1.3 CHRISTENING WITH A PULSER

Who did the Engineers' Queen, Mary Rowan (2nd Year B Ed student) would have been asked to perform such a unique task. Jack Blair is standing next to the Wheel to ensure its safety under the impact.



Plate 1.4 THE ESCAPE PIN

The Wheel displaying The University of Calgary's original logo.

Evolution of A Faculty Symbol



Plate 15 THE WHEEL STATUE
ENGINEERING MAIN FOYER

Presented to the Faculty by Engineering by
The Graduating Class May 1970

1963 and was christened by the *Engineering Queen* with a bottle of Pilsener (see Plates 12 and 13). It prominently displayed its message "Autonomy 1967" and stayed at that location in the central quadrangle until the new Engineering Building was completed in August 1964. At the start of the fall term 1964 it was moved by the engineering students next to and immediately east of the main entrance to their new home - the present E-Block. There it was to remain as a permanent symbol of the engineering students' contribution to the autonomy movement.

Sometime thereafter, on a Monday morning it was noticed that the wheel was missing. Excitement ran high amongst ESS executives! What could have happened to our wheel? It was of a size and weight which made it difficult to move on the spur of the moment and without proper equipment. It was discovered subse-

quently that the wheel had not been moved from its location at all. At least not very far. Apparently some enterprising (non-engineering, no doubt) students had dug a large hole behind the wheel, tipped it into the hole and covered it over, never to be seen again. Since the whole area (the present engineering courtyard and its southern extension) had been and continued to be a construction site, a freshly covered hole was easily camouflaged and not readily noticeable. When the wheel was recovered it was in a badly damaged state, was placed in the backyard and ultimately went the way of a used concrete.

The wheel, or at least its concept, however, would not die. It reappeared soon thereafter in the form of a tape pin (see Plate 14) and then was reincarnated in a multidimensional form as part of a statue/art work presented to the Faculty of Engineering by the Class of 1970 and displayed in the main foyer of the Engineering Complex (see Plate 15). Over the years the students have used *The Cogwheel* as the title for their annual ESS *Freshman* booklet. It was adopted as a motif for the Dean's List display cabinet (see Plate 16, and most recently in a stylized form as the logo of the Engineering Faculty Newsletter *Engnuity* (see Plate 17).

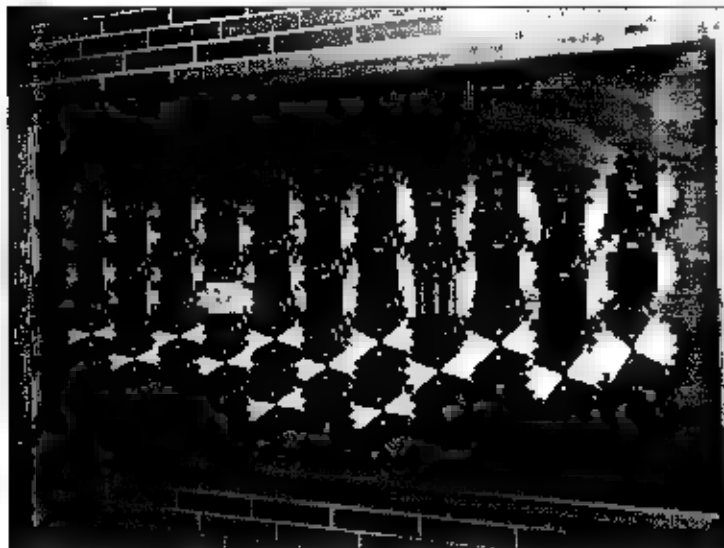


Plate 16 DISPLAY CABINET STAIR LANDING IN MAIN FOYER

To recognize a student's outstanding academic performance in any year of the programme, the Dean's List was instituted in 1971-72 during Dr. R.A. (Bud) Ritter's Deanship. The display cabinet was designed, constructed and installed in 1977 at the initiative of Prof. A.A. Alt Iriv and with the support of the Dean, Dr. T.H. (Tom) Barton. The cogwheel motif was suggested by Mr. Bruce Jinterberger, Technical Supervisor of the Engineering Faculty's Drafting and Photographic Services from 1965 till 1996.



Plate 17 NEW LOGO FOR FACULTY NEWSLETTER

The revised format of the Faculty of Engineering Newsletter *Engnuity*, the first issue of which was edited by Katherine Rempe, Communications Manager of the Faculty of Engineering April-September 1991. The Newsletter displays this winning logo designed by Dr. G. Lachapelle, Professor of Surveying Engineering. The design was selected from a number of alternatives and adopted by the Faculty's Public Relations Committee on July 4, 1991.



3

PGE



0

PGE

Plate 18 — Ice sculptures in the Engineering Courtyard Engineering Week Jan 23 1992

A Place of
INGENUITY

II.

Faculty of
ENGINEERING

THE SILVER ANNIVERSARY



Photo 1.1 View to the Campus from A.W. Engineering Complex in the central area of the campus with its main parts referred to as Blocks designated by the letter A-F (see Figure 1.1.2 Section 1.1)

Before embarking on our short trip back through time let us briefly examine the Anniversary year by

- taking a tour of Engineering's physical facilities
- summarizing current salient features of Engineering and highlights of the 1990-91 academic year

The University of Calgary main campus, 1230 hectares (304 acres) in size, is located in northwest Calgary next to and west of Crowchild Trail (Highway No. 1A). It borders on 32nd Ave. and 24th Ave. along its northern and southern perimeters, respectively. Its west boundary is shared with the 74.3 hectares (183.6 acres) Higher Education Reserve owned by the Province of



Photo 1.2 View of the Engineering Courtyard (view from S.E.)

The Engineering Centre and Faculty – 1991

Abera and used by the University as a tree farm. To the north of the campus is the 50.6 hectares (125 acres) University Research Park, also crown land, established in 1966 and in 1991 the home of more than 30 R & D organizations housed in 10 modern research facilities. One of these, the Petro Canada Building, was leased by The University of Calgary in the spring of 1991 and became the *new home* of the Department of Mechanical Engineering in July of the same year.

The Engineering Centre is the most northwesterly academic building complex on campus in 1991 with only Physical Education's buildings located slightly west and to the south of Engineering. The northern facade of the Centre and its northernmost extension, the Energy Transfer Laboratory, is just south of 32nd Avenue as is clearly shown on Plates 2.1 and 2.4. Exterior ground-level views of the Centre are depicted in Plates 2.2 and 2.3 with additional photographs of the Centre shown throughout the book.



Plate 2.1 The New Engineering Wing (F Block), view from S.E. ca. 1984

The aerial view in Plate 2.4 indicates the orientation and overall J shape of the Centre with the sides of the J pointing due south, thereby providing a southerly exposure to the engineering courtyard. This plate also shows the date of completion, the size and use of various parts of the Centre referred to as *Blocks*. With

the exception of the most recently completed F Block, parts of the Engineering Centre were completed in reverse alphabetical order with E Block being occupied in 1964 and A Block in 1968. Landscaping and construction of the courtyard fountain were completed by 1970.



Plate 2.4 Aerial view of the Engineering Centre from S.W. the Science A building, the last home of Engineering on this campus, appears in the top right corner of the photograph denoted by S ca. 1982-83 (see also Plates 2.58 and 6).

A	Electrical and Computer Engineering Block ASM: 2827 (1968)
LTA	Lecture Theatre Block (1968) ASM: 1326
B	Mechanical Engineering Block (1967) ASM: 2290
ET	Energy Transfer Laboratory (1967) ASM: 2050
C	Central/Administration Block (1966) ASM: 1932
D	Chemical and Petroleum Engineering Block ASM: 2087 (1966)
LTE	Lecture Theatre Block (1966) ASM: 834
E	Surveying Engineering Block (1964) (Civil Engineering Prior to 1982) ASM: 2948
F	Civil Engineering Block (1982) (New Civil Engineering) ASM: 4223
PC	Petro Canada Bldg. (1991) (Mechanical Engineering effective Fall 1991) ASM: 3440; GSM: 6000
EC	Engineering Courtyard (1970)
Total GSM: 36,712 (without PC)	
ASM (GSM) ASSIGNABLE (GROSS) SQUARE METERS	



Plate 2.5 The 1991 Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA) Gold Medal winners. All of them graduated with distinction and achieved the highest Grade Point Average (GPA) in their respective departments. In addition, Christopher Kulach obtained the highest academic standing of any undergraduate at the time 1991 University of Calgary convocation for which he was awarded the Governor General's Medal and the Muriel Kovitz Prize. Jim Wilton-Clark won the 1991 Atholene Varner Engineering Fellowship, one of only three such awards in Canada, which will take him to Imperial College, London. Rob Hale won the EIC Engineering Student of the Year Medal.

During the academic year 1990-91 the Faculty of Engineering with its five departments operated with 1,734 full-time and part-time students including 1,263 and 196 full-time undergraduate and graduate students, respectively. Approximately 15% of the full-time registrants were women. The 1990 Spring and Summer Session registrants in engineering courses numbering 515, are not included in these statistics. Although most of the undergraduates are from Calgary and southern Alberta, there are some registrants who hail from other parts of Canada, from the U.S., and from over 40 different countries on 5 continents around the globe providing an interesting and somewhat cosmopolitan atmosphere to student life, especially at the graduate level. These students were registered in BSc, Diploma, MEng, MSc and PhD programmes in Chemical, Civil, Electrical, Mechanical and Surveying Engineering. Minors in Computer Engineering and in Computer Integrated Manufacturing (CIM) are offered by the Department of Electrical and Computer Engineering and by the Department of Mechanical Engineering, respectively. A Diploma programme in Project Management and a joint five-year double-degree BSc/BA programme offered through a joint undertaking between our Faculty and the Faculties of Management and Humanities, respectively, as well as an International Cooperative Master's programme are

also available, the latter two of which were introduced in 1989 at the initiative of D. L. T. Brown, the Dean of Engineering from 1985-1990.

The Faculty's teaching, research, service and administrative activities involved 91 and 96 full-time academic



Plate 2.6 Dr. M. Elizabeth Cannon accepting the International Federation of Surveyors (FIG) prize from Mr. Juha Tahvonen, President of FIG, during the opening ceremonies of their XX quadrennial Congress at the Finlandia Hall, Helsinki, June 10, 1991. Having from Charlottetown, Elizabeth is only the second woman in Canada to be awarded the PhD in her field. In March 1991 she was also awarded an NSERC Women's Faculty Award \$275,000 over five years, one of only four such awards in Engineering during the inaugural year of the programme. Dr. Cannon was appointed Assistant Professor in Surveying Engineering effective May 1991.

and support staff, respectively, and 57 full-time and part-time sessional instructors, research associates, post-doctoral fellows, visiting professors and research assistants. Most of the full-time graduate students were involved as Graduate Teaching Assistants (GTAs) in undergraduate teaching, especially in laboratory and tutorial classes. Financing was provided by a \$11.75 million operating budget, a \$0.70 million capital equipment budget and \$5.75 million in external research grants and contracts.

There were 1,330 engineering graduates in 1990 with 273 further engineering degrees granted at the June 1991 Convocation (see Fig. 2.1). Many of the students excelled in their studies and won prestigious awards, scholarships and prizes, a few of which are shown on Plates 2.5 and 2.6.

The research work of the academics during the anniversary year continued in a wide spectrum of specializations

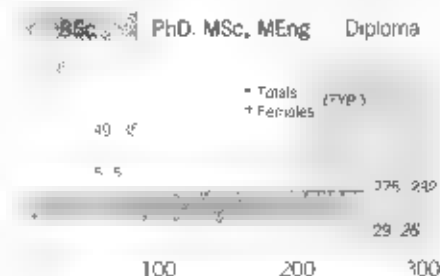


Fig. 2.1 Engineering Graduates 1990 with June 1991 figures in italics.

producing significant results, many of which were relevant to the economy of Alberta. Highlights are given in the departmental chapters with only a few of the many outstanding examples shown here (see Plates 2.7-2.13). In Chemical and Petroleum Engineering a number of groups continued to focus on hydrocarbon energy resources, the recovery, processing and related topics. The research strength in Civil Engineering continued to reside mainly in its materials and structures groups with emphasis on concrete as a structural material, reinforced and prestressed concrete structures and structural analysis. One of the noteworthy highlights of the year for the Faculty of Engineering was the awarding of the 1991 W. Kilam Memorial Prize to a member of the Structures Group, Dr. W. H. Dilger, for his outstanding and innovative work on bridge design and structural engineering (see Plate 2.7). Research



Plate 2.8 MSc student Mr. Darryl Caswell (left) and Maestro Mario Bernardi, Conductor of the Calgary Philharmonic Orchestra, testing prototype bell-plates in the Jack Singer Concert Hall for a performance of Beethoven's Symphony Fantastique in March 1992. The vibrational acoustic characteristics of Darryl's plate bells is the subject of his research supervised by Prof. Marcelo Fasten in the Department of Mechanical Engineering.

in Electrical and Computer Engineering ranged from communications and very large scale integrated (VLSI) circuit design to high temperature electronic studies, power systems and signal and image processing, a member of the latter group of which, Dr. L. T. Bruton, won the prestigious Manning Awards top prize for Canadian innovation (see Plate 2.11). Academics in Mechanical Engineering dealt with problems of engines including Stirling engines, combustion, material science, vibration and stability of structural and



Plate 2.7 Dr. Walter H. Dilger, Professor of Civil Engineering and recipient of the \$50,000 Frank Walter Kilam Memorial Prize for 1991, standing near the Northwest Light Rail Transit (LRT) Bow River Bridge in Calgary, which he designed in cooperation with Dr. Gamal S. Tadros and Mr. David J. Wondolai, both former graduate students in Civil Engineering at The U of C. The bridge won two international awards for its innovative design: the Post-Tensioning Institute, 1987 Award of Excellence and the 1988 Concrete Bridge Award of the Portland Cement Association.

machine elements, pollution and the environment, and the use of computers in design and manufacturing. There are three main research areas in Surveying Engineering, namely geodesy and navigation, geomatics and precise engineering surveys with a number of their staff involved in global satellite positioning and automatic positioning of vehicles using satellite referencing.

In addition to these departmental research areas, there are interdisciplinary groups in which individuals with varying backgrounds join forces to tackle highly non-linear problems of ever increasing complexity for which the large-scale supercomputers now admit at least a numerical solution. One of the most rapidly expanding interdisciplinary areas in the Faculty is biomedical engineering, involving 36

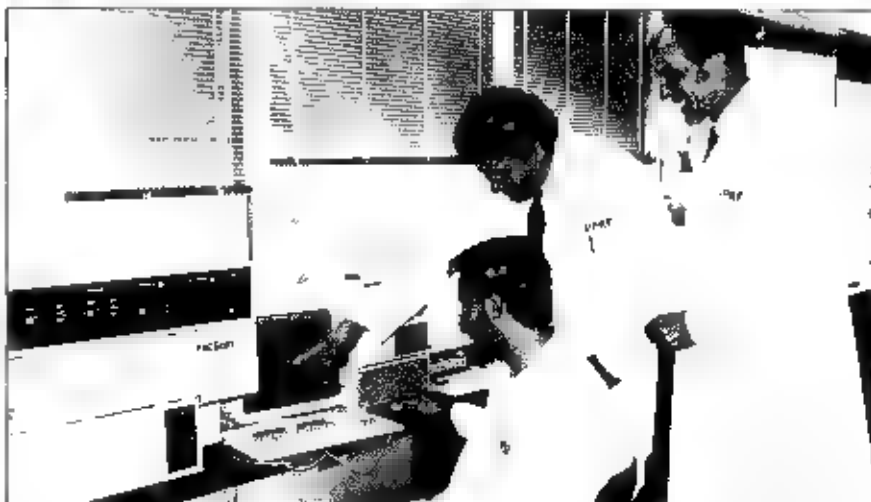


Plate 2.9 Drs. Leo A. Benisek (left) and Dr. E. Nick Kallogerakis, Professors of Chemical Engineering and Co-Directors of the newly established Pharmaceutical Production Research Facility (PPRF) at The University of Calgary, with their recent PhD graduate, Dr. Ted Leonardos, seated, discussing key kinetic parameters, testing the functioning and replication of the human cell culture micro-reactor located in DISCOVERY PLACE, a new high-tech business and research innovation center in the University Research Park. PPRF is a biochemical engineering laboratory specializing in tissue culture and biopharmaceutical production, problems such as: 1) human vaccines, 2) monoclonal antibodies for diagnostics and cancer therapy, and 3) subunit vaccines using genetically engineered insect cell viruses. Current 1992 funding for the Center exceeds \$1.0 million. August 1992.

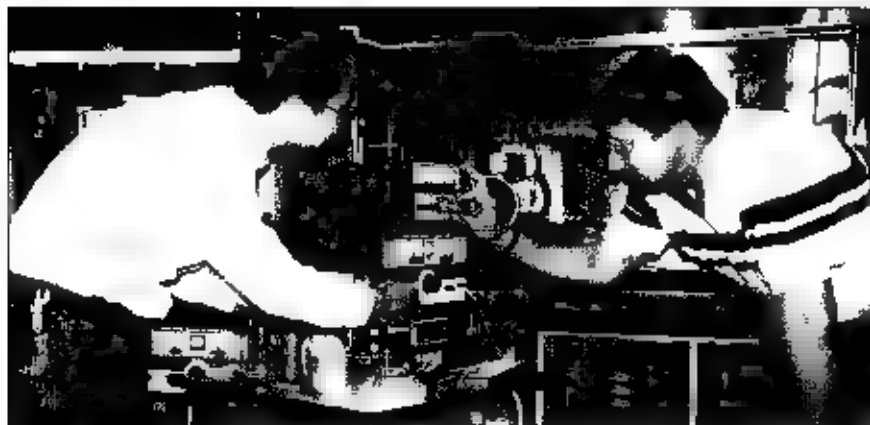


Plate 210 Drs. W. D. Shaw (R) and X. Mao in one of the Mechanical Engineering Materials Research Laboratories working on advanced material science problems dealing with mechanical alloys and electro-chemical corrosion. Their external research funding which is new for Dr. Mao extends \$200 000 per year and is obtained from industrial and governmental sources including the inst. of Chemical Science and Technology and NSERC. This funding has allowed acquisition of state of the art equipment required for such fundamental studies. Aug. 1999

staff members from the Faculties of Engineering, Medicine and Physical Education, 16 of whom are from Engineering encompassing every department. This group is involved in what is probably Canada's largest and most extensive biomedical engineering programme. Other interdisciplinary areas include transportation for which the *Institute for Transportation Studies* coordinates the work of academics from five faculties including Engineering. Until January 1990 and for over 10 years the chairman of this institute was Dr. John F. Morris (CE). *Environmental engineering* is another rapidly growing interdisciplinary specialization, involving at least three of the five Engineering departments and units

in Biological and Earth Sciences. An environmental engineering fourth year option and a Diploma programme specialization has been proposed by Civil Engineering.

Additional highlights and achievements of the anniversary year include:

- A Node on the MICRONET Federal Network of Excellence on Microelectronic Devices, Circuits and Systems for Ultra-Large Scale Integrated Circuits was established and funded by a four year NSERC grant of some \$900 000 awarded to the Signal and Image Processing Group, which is spearheaded by Dr. L. T. Bruton and includes Drs. S. T. Nichols, M. R. Smith and R. A. Stein.
- Dr. Roger M. Butler's pathbreak-

ing R&D work on a relatively environmentally friendly method for heavy oil recovery using horizontal well drilling with steam assisted gravity drainage was recognized by selecting him as recipient of the ESSO Resources Significant Innovation Award for 1990.

- Dr. A. Ghaffari (CE) acted as advisor and consultant to engineering consulting firms in Paris on the design of liquid natural gas LNG prestressed concrete storage tanks in Turkey, cable-stayed prestressed concrete bridges in Korea and France and the Amaçgak Arctic Production Platform in the Beaufort Sea owned by Gulf Canada Resources Ltd.
- Drs. G. (Joe) Walker and Graham T. Reader (ME) completed two reference books on Stirling engines one of which was in print by year's end. A revised edition of Walker's *Industrial Heat Exchangers* appeared and was chosen *book of the month* by McGraw-Hill. The first volume in a trilogy on *Electrical Circuit Analysis* by Reader and Richardson was published with the second volume also completed.
- Dr. R. C. Joshi (CE) was awarded a Senior Fellowship by the Japan Society for Promotion of Science (JSPS) which took him on a 3-month tour of Japanese universities and research institutes. While in Japan he presented invited lectures at 7 major universities, gave advice and prepared a report on the state of geotechnical engineering research in Japanese institutions.



Plate 211 Dr. L. T. Len Bruton (L) with the Hon. Ernest Manning after being awarded the 1999 Ernest C. Manning Award's principal \$ 50,000 prize for his innovative research contributions to the development of electronic filters, used throughout the world for enhancing electronic signals, including audio phone transmissions. Sept. 25, 1999.

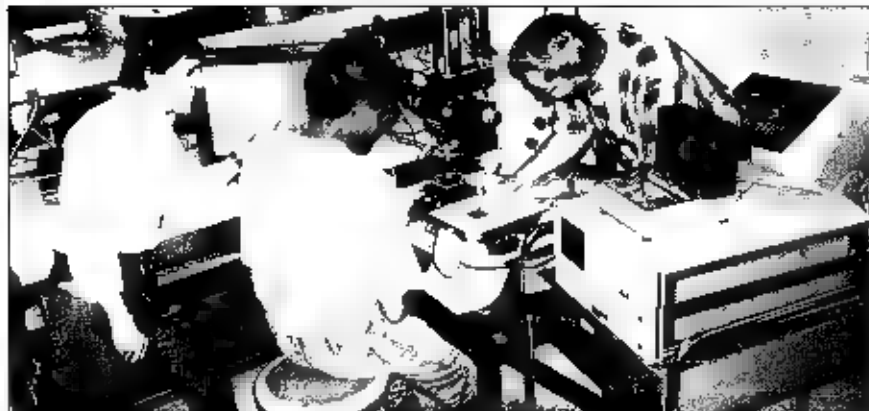


Plate 212 Drs. W. Hasielt (R) and B. Nowrouzian (L) two of the five member Very Large Scale Integrated (VLSI) Design Group of the Department of Electrical and Computer Engineering, examining one of their integrated circuit designs with MSc student S. Balasubramanian (C) a design carried out in the new VLSI Design Laboratory on equipment obtained through major grants totalling \$270 000 from the Canadian Microelectronics Corporation and NSERC. Aug. '91.

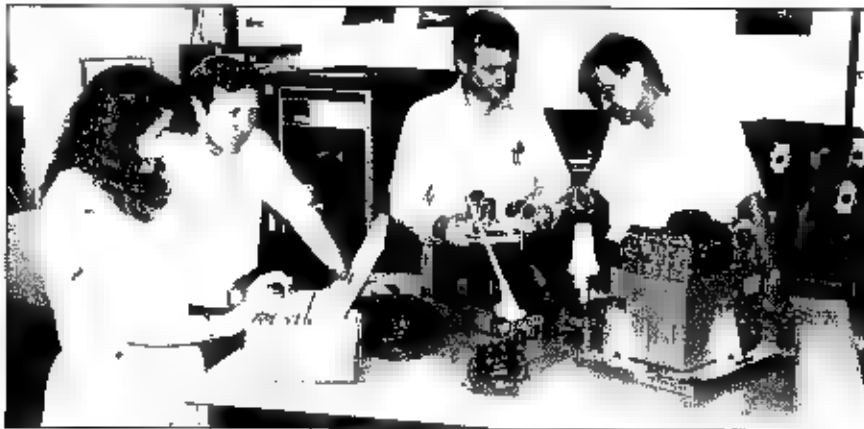


Plate 2.13 The Inertial Navigation (INS) and Global Positioning System (GPS) Group in Surveying Engineering. Dr. M. Elizabeth Cannon, Dr. K.P. Schwarz, Dr. J. Lachapelle and Dr. E. Krakowski with some of their research equipment valued at over \$500,000 and obtained through major NSERC equipment grants or donations from industry. The group attracted international attention for applying inertial and satellite technology to precise positioning and navigation including real-time GPS/INS integration and automatic vehicle positioning an area likely to revolutionize automobile traffic movement and control during the 1990's. July 1991.

- The recognition of the research of Dr. P.R. Bishno and the Hydrates Research Group (ChE) through invitations for lecture tours to Norway and the USSR and new external funding from the US Gas Processors Association, the JS Gas Research Institute and Shell Research BV (Amsterdam)
- The appointment of Dr. Alec C. McEwen to the newly established professorship in Cadastral Studies in Surveying Engineering, made possible by the financial support from the four Western Canadian Land Surveying Associations
- Dr. I. Muzik (CE) was invited and seconded to the Asian Institute of Technology, Bangkok, to offer a 3-month course in hydrology and remote sensing
- Profs. G.J. Berg (EE), A.G. Doige (ME), M.A. Sargous (CE), and F.N. Trofimukoff (EE) were ac-

tive in the Nepal Engineering Education Project, funded by CIDA and administered through the Division of Int. Development at U of C. The project at the proposal stage of which Dr. P.J. Vermeulen (ME) was involved is aimed at preparing detailed plans for new BSc programmes in Engineering and Architecture at Tribhuvan University in Katmandu, training Nepalese staff and providing assistance with laboratory and curriculum development, institute administration and implementation of the new programmes. The Canadian contribution to this project is managed by G. Berg and is supported by a consortium of four Western Canadian Universities (JBC Calgary, Sask., Manitoba) headed by U of C.

- Celebration of the Tenth Anniversary of the Undergraduate Student Exchange Programme between the Technical University of Stuttgart and our Faculty to which Dr. W. Diger, its initiator, was invited. The programme is supported by the DEUTSCHER AKADEMISCHER AJSTAUSCH DEINST DAAD.



Plate 2.14 Alumni Association President Jim Logan (left) and University President Murray Fraser flank W. Barry Lester and his wife Diane (nee Ashcroft) at the Distinguished Alumni Award Reception October 24, 1990. Barry BSc '69 and MSc '71 from Civil Engineering was recognized for his contributions as an outstanding structural engineer whose most widely known projects include the University's Olympic Oval, the Eric Harvie Bridge and Peter Lougheed Hospital in Calgary, the Medicine Hat City Hall and the Students Union Building at the University of Lethbridge. Barry is only the second engineering alumnus to be selected for this distinction, the first being the inaugural Distinguished Alumnus in 1985, Dr. Robert Threlk BSc Mech. Eng. 1976, one of the first Canadian astronauts.



Plate 2.15 M. John Bromley, Vice President, CP Rail Vancouver, accepting the Faculty of Engineering's F.E.S. Engineering Excellence Award from Dean L.T. Bryton on January 21, 1990. Present also was Mr. John Fox, Vice President, Engineering Special Projects, retired, who was responsible for the construction of the award winning \$500 million CP Rail Rogers Pass line including the longest tunnel in the western hemisphere. The more than 500 guests attending the presentation ceremony at the University were treated to a 90 minute video, *The Challenge*, which recounts the building of the largest Canadian railroad project since the construction of the original trans-continental line.

THE BEGINNINGS

Let us start by going back to 1957 the year probably best known by most people for the launching of the first artificial satellite. It was on Friday October 4, 1957 that Sputnik orbited the earth heralding the dawn of modern space age. Exactly one week earlier, on Friday September 27 lectures began for first year Engineering students at the southern campus of the University of Alberta marking the dawn of regular University Engineering education in Calgary. The classroom filled with 59 eager young men ready to become engineers was located in an old wooden barrack from the days of World War II when the campus of the Institute of Technology and Art (now the Southern Alberta Institute of Technology SAIT and Alberta College of Art) was a training centre for wireless operators (see Plate 16).

The physics, chemistry and mathematics content of the first year Engineering curriculum was carried by the academic staff of the Faculty of Arts and Science who had been offering their first year programmes for six years. To look after the six Engineering courses two Civil Engineering staff members H.R. McArthur and W.H. Stilwell were on hand.

Harold Russe McArthur had been hired by Dean R.M. (Bob) Hardy as Assistant Professor of Applied Mechanics in Civil Engineering effective September 1, 1954. In the spring of 1957 the Dean asked him whether he would be interested in going to Calgary to start up the first year Engineering programme. Having spent two years teaching at Mount



Before

September 1957

After

Plate 15 The home of Engineering at the Southern Alberta Institute of Technology

Royal College prior to joining the Faculty of Engineering in Edmonton. Russ was happy to move to Calgary and be responsible for Engineering at the southern campus. He was promoted in the rank of Associate Professor during the summer.

During the spring of 1957 Dean Hardy visited Victoria where he met and subsequently hired Walter H. Stilwell as Assistant Professor effective September 1 of that year. Walter's experience with the Dominion Astrophysical Observatory, with Geodesic Survey of Canada and with Topographic Survey of B.C. made him technically well qualified in surveying, drawing and measurements. He moved to Calgary, worked during the summer for a Calgary surveying consultant and was ready to start

lecturing at the SAIT campus in September. Details of the events leading up to the decision to start first year Engineering in Calgary are summarized in Appendix A.

Arrival of the first engineers at the SAIT campus resulted in more than just changing the sign above the door on the old Arts and Science building indeed as Ronald Brien, class historian from this first Engineering group stated in his *Class History* the fact that engineers were on the campus for the first time this year enriched and complicated the whole campus picture. They were involved and active in almost all aspects of student life some of which are summarized in Appendix B. They were not only an active but also an unusually talented group of young men. Many of them won awards, prizes and medals and had bright careers ahead of them (see Appendix B).

During the summer of 1958 over 100 applications were received by Professor McArthur of which only 75 were admitted due to limitations in space and resources (see Fig. 2.2). It was during the academic year 1958-59 that the decision of the Board of Governors (1957-02-01) to change the name of the Calgary campus to



H.R. McArthur



Marjorie Rier



W.H. Stilwell

Plate 16 The first Engineering Staff in Calgary

First Year Engineering at SAIT 1957-1960



Plate 2-18 PROGRESSION: A sign on the New Campus site along the Old Banff Highway indicating construction to be imminent or in progress - view towards NW

University of Alberta in Calgary (UAC) became generally known and its significance appreciated. It was perceived to be such a significant step towards *autonomy* that the students called their 1959 yearbook *PROGRESSION* meaning *we are progressing*. It was also during 1958 that Professor McArthur hired Mrs. Maude Brier who was to be the Head Secretary in Engineering at Calgary for over 4 years.

The President Dr. Andrew Stewart resigned at the end of the academic year. Before leaving he sent his congratulations to Professors McArthur and Stilwe and expressed the University's appreciation to them for getting the first year Engineering programme in Calgary started with very modest resources.

Probably the most significant event of the 1958-59 academic year was the appointment of Dr. G.W. Govier as Dean of the Faculty of Engineering effective July 1, 1959. R.M. Hardy had resigned his Deanship in May of that year to devote himself full time to his consulting practice, having served as Dean and Head of Civil Engineering for 13 years. He continued as part time research professor and was to return in September 1963 for a further eight years as Dean until his final retirement in 1971. George Govier, as will become apparent, was to become a key player in the planning and build-

ing of the Faculty of Engineering and the Engineering Centre at The University of Calgary.

Enrolment in the fall of 1959 decreased slightly with 69 engineers listed in the 1959-60 yearbook (see Fig. 2-2). The programme and the engineering staff continued to be the same as in the previous academic year. Considerable time was spent by the two staff members in planning for the new facilities and the equipment which would be required for the planned expansion of the Engineering programme effective September 1960.

The engineers continued to be a most active group. For the first time

there was a female student amongst them. Margaret Jean Coatsworth who was elected Secretary Treasurer of ESS (see Appendix B).

Site clearing at the new campus began in the spring and early summer of 1959 with construction getting underway in late summer on the first two buildings, the Science and Engineering Building (now Science A) and the Arts and Education Building (now the Administration Building). Construction progress on the two buildings was slow at first so that the Dean expressed concern in Engineering Faculty Council about the facilities becoming available in time for the start of the second year programme in the Fall of 1960 (see Appendix A). It is a credit to the general contractor that the new facilities were ready before the fall session classes began.

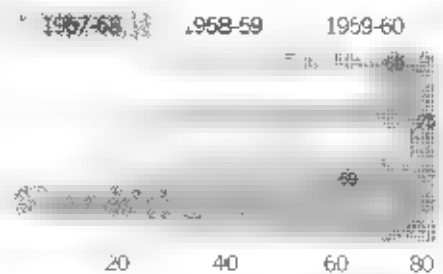


Fig. 2-2 First Year Enrolments 1957-60

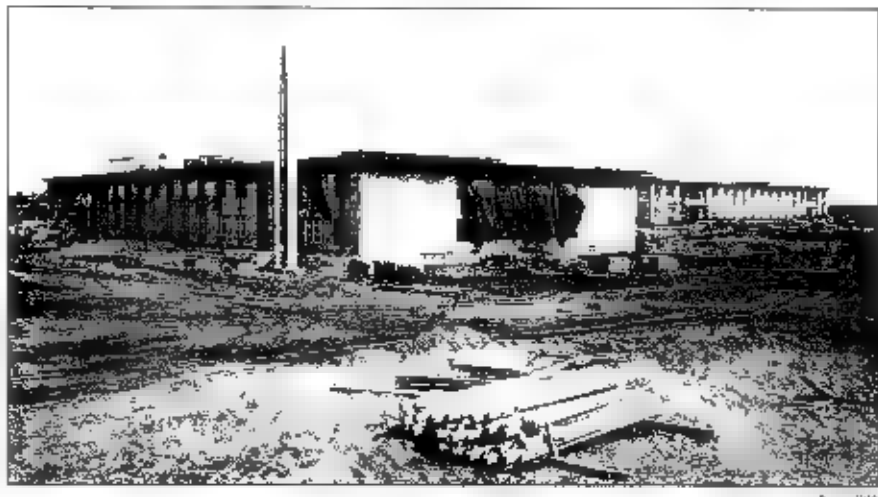


Plate 2-19 The Science and Engineering 'foreground' and the Arts and Education Buildings during the Spring of 1960

THE NEW CAMPUS



Plate 2.28 The campus along the west side of the Old Barrut Highway with the Arts and Education and Science and Engineering Buildings relatively close to the road (central right area of photograph) and the Physical Education Complex farther to the west (central left area of picture) - ca. 1961/62.

The opening of the new University campus in the Fall of 1960 made headline news in Calgary and so did the appointment of Dr. Malcolm G. Taylor as Principal and the official opening of the two buildings on Friday, October 28. The ceremonies were held in the Arts & Education Building foyer and included *cutting of the ribbon* stretched across the main stairway which helped to raise the jubilant spirits of those attending and of many celebrating Calgarians (see Plate 0.5).

An equally significant event for Engineering was the inauguration of the second year of the programme at Calgary. Students who had successfully completed their first year studies the previous year could now continue their engineering education in Calgary for a further year. Of the 51 students constituting this initial Calgary second year Engineering class, 44 were members of the 1959-60 first year group, the last SAIT Engineering class. The publicity associated with the opening of the new campus, its increased facilities and the expanded Engineering programme offerings resulted in an increased first year enrolment of 99

a most 50% larger than the previous years (see Fig. 2.3).

Expansion of the Engineering programme required additional staff. Three academics from Edmonton, A.G. Dodge, P.G. Glockner, and R.H.B. Hebbert were transferred to Calgary. Alan Dodge and Bob Hebbert had been sessional instructors in Mechanical Engineering for 8 months before being appointed Assistant Professors in May 1960. Peter Glockner was hired by Dean Hardy as Assistant Professor of Civil Engineering during the late Fall of 1957

and started teaching on February 1, 1958, due to the Dean's absence caused by his membership on the Borden Royal Commission. Thus there were 5 Engineering academic staff in Calgary in the Fall of 1960. Professor McArthur's administrative responsibilities were formalized by appointing him Secretary of the Faculty of Engineering at Calgary.

The Engineering offices were located at the east end and along the inside of the south corridor in the Science and Engineering Building. In addition to Maude Brier, part-time secretaria

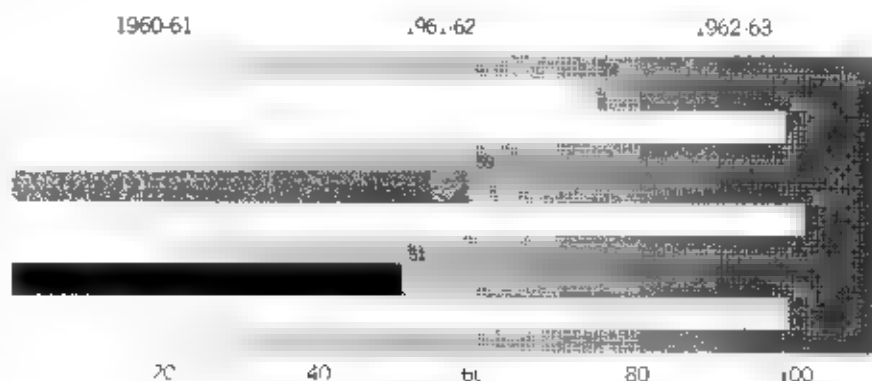


Fig. 2.3 Enrolments in First and Second Year Engineering, 1960-63
Second Year: (dark) (light)

Blueprinting a Faculty 1960-1963

staff was also available to support teaching and initiation of research. The large first year class was split into two sections, sections A and B, with most classes being held in the two large drafting rooms (laboratories) at the east end of the building. The laboratories were located in the basement and housed substantial new equipment, some of which enabled the staff to start research activities. Thus, for example, Aa Doige initiated fatigue studies while Peter Glockner started the first structures research project at AC dealing with square bar pin reinforced concrete slabs supported on four concrete columns after he had been successful in obtaining a steel testing frame from the Canadian Institute of Steel Construction (CISC) during the winter of 1960-61 (see Plate 2.27).

Dr Taylor invited the academic and senior administrative staff on a two day retreat to Banff Jan. 13-14, 1961 which became known as the *Banff Conference* (see Plate 2.27a). The meeting brought forth many suggestions for developments and

possible directions for the budding institution. At the Closing Session 14 resolutions were passed of which two were proposed by the engineers. The idea of a conference on *higher education* at AC was also discussed.

The most significant event of the 1960-61 year, and one of the most important events for the development of this Faculty, was the submission by Dean G.W. Govier of a report dated 1961-02-15 entitled *A Long Term Development Plan, 1961-1980 for the Faculty on the Edmonton and Calgary Campuses*, which had been prepared by him with generous assistance from the Engineering Department Heads and other individuals. The document



A.C. Doige

Plate 2.27a: Three members of



P.C. Glockner

from a group of which the staff of Calgary at



H.D. Taylor

uses projections for Engineering undergraduates and graduate enrollments to forecast requirements for staff and physical facilities. The space requirement projections led to the idea of the development of Engineering Centres at each of the Calgary and Edmonton campuses.

For Calgary the report envisages an Engineering Centre composed of separate buildings for each of four departments: Chemical, Civil, Electrical and Mechanical Engineering, with a fifth *general use* building in the centre of the complex. It pro-



Plate 2.27b: Entrance to the Engineering Centre on Banff Highway which served as a main access during the early 1960s. It was replaced in 1965 when the new Engineering Centre was inaugurated at the University of Alberta.

poses the first unit of the Centre later to become the Civil Engineering Building to be constructed by September 1963. The document recommends that third and fourth year programmes be initiated in 1967 and 1968, respectively, in the four departments mentioned and that prior to those dates the departmental buildings be completed.

Reading this report and knowing what actually happened one cannot help but be struck by the precision with which it described the future with regard to the development of our Engineering Centre and Faculty of Engineering. It was and remains a model for long term development plans and can justifiably be referred to as the *blueprint* for the Eng-



Plate 2.23 The campus a few weeks before start of the Fall Session in 1960



Plate 2.24 Mrs. Lesia Hawrelak (R) and Mrs. Marguerite Fenves, nee Groulx, in Mathematics, in the southeast corner of the open inside courtyard of the Science and Engineering Building. The Engineering offices were inside the windows along the wall appearing in the top right corner of the photograph. The courtyard was converted into terraces when space became scarce. The identical exterior courtyard in the Arts and Education Building was covered and is used as an indoor garden and lounge area. Summer 1963

neering Faculty at The University of Calgary (see Appendix C).

The various academic and physical expansion implications of this long term plan referred to as the *Gover Report* were considered and endorsed by the Academic Planning Committee and by the Campus Planning Committee respectively and approved by the Board of Governors during 1961-62 (see Appendix C).

In the Fall of 1961 the number of academic staff increased to 6 with the

appointment of Dr. H.A.R. Rodde Paiva as Assistant Professor of Civil Engineering effective September 1, 1961 who had just finished his PhD in structural

engineering at the University of Lethbridge. The secretarial staff was increased by hiring Mrs. Lesia Hawrelak in July 1961 and Mrs. Marjorie May on Jan. 1, 1962 both on a part-time basis. The first year enrolment stayed static at 102, while the 2nd year group increased to 59. The first year class included Elizabeth Coult, from Estevan, Saskatchewan who was elected Secretary of ESS.

One highlight of the activities of 1961-62 was the series of four Conferences on Higher Education, the third one of which dealt with *Education for Engineering* and was held February 16-17, 1962. As the Engineering member of the Committee for Conferences on Higher Education (CCHHE), Peter Glockner was responsible for the organization of this conference.

In September 1962 A.G. Doige and P.G. Glockner went on study leave. Walter L. Bagg from Civil Engineering in Edmonton was trans-



Lesia Hawrelak H.A.R. de Paiva Marjorie May
Plate 2.25 New staff in Engineering at Calgary 1961-62



Plate 26 The walkway is used to enjoy the outdoors on the new campus, in front of the Science and Engineering Building Fall 1961, view towards N.W.

ferred to Calgary for an 8 month period. The resignation of Dean G.W. Govier, accepted by the Board on Oct. 5, 1962 and effective May 31, 1963, became known before Christmas. He had decided to work full time as Chairman of the Oil and Gas Conservation Board and move to Calgary. R.M. Hardy was appointed Dean effective September 1963 with Associate Dean L.E. Gads serving as Acting Dean for the interim period.

At its meeting of Feb. 1, 1963, the Board of Governors approved the establishment of a Division of Engineering at the University of Alberta, Calgary, effective April 1, 1963 with a Chairman who was to have the status of Department Head. Dr. Adam M. Neville, Professor of Civil Engineering at the University of Saskatchewan since September 1962, was selected to become Chairman of the Division. His appointment was approved by the Executive Committee of the Board at its meeting on May 2, 1963 (Minute #4s) with the appointment date revised from Aug. 1 to July 1, 1963 at the May 28 meeting of the Executive Committee (Minute #5c). Prior to his arrival, the Engineering staff at Calgary was to decrease further due to the resignation of R.H.B.

Hebbert effective June 30, 1963 who decided to move to Australia with his family. Professor H.R. McArthur took a leave of absence effective July 1, 1963 to go to the

Singapore Teachers' College in Malaysia under the auspices of the Colombo Plan. He returned in 1966 but resigned to take a position at Se Kirk College, Nelson, B.C.

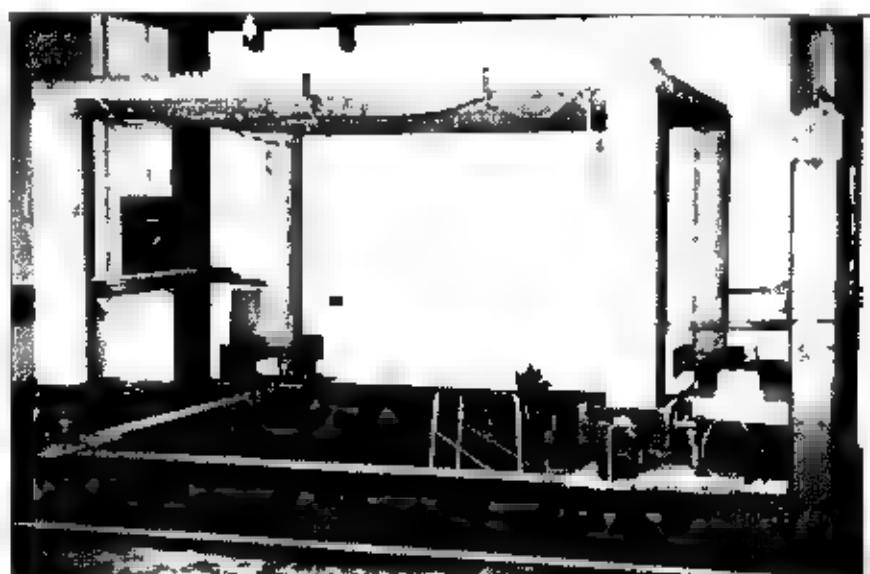


Plate 27 R/C flat plate floor slab being instrumented for testing in the test frame which bore the following plaque inscription: PRESENTED WITH THANKS TO THE CANADIAN ASSOCIATION OF ENGINEERS IN CONSTRUCTION WESTERN REGIONAL COMMITTEE ALBERTA DIVISION. This first equipment donation to Engineering at Calgary was obtained with the help of Mr. John B. Wheeler, Western Regional Representative of C.S.C. and Mr. George Pittbrow, Manager of Calgary Structural Steel Ltd. who provided free laboration and installation on this project. The frame was installed in February/March 1961 and was to serve members of the Structural Group in the Engineering for nearly two decades. The water's infiltration after 1961 with Rod de Paiva on the flat plate of test was initiated in the jointly supervised MSc work of Ramzy Zaghlool.



Banff Conference The Design of the University of Alberta Calgary

Identification Key for Plate 2.27a

Banff Conference, Jan 13-15 1961

- | | |
|-------------------------------|---------------------------|
| 1 William E. Gandy | 31 Robert H. B. Hebbert |
| 2 Alan G. Doige | 32 Mary A. Beaton |
| 3 Joseph G. Woodsworth | 33 James A. Stewart |
| 4 Philip Warren | 34 Mary P. Hendrickson |
| 5 J. Douglas Aikenhead | 35 James G. Snide |
| 6 Richard C. B. Hartland Rowe | 36 Malcolm G. Taylor |
| 7 Germaine L. Abbe | 37 Ethel M. King |
| 8 Harvey A. Buckmaster | 38 Peter Cocking |
| 9 Makoto Takeo | 39 Allan Hermes |
| 10 John E. Oyle | 40 Anthony S. B. Holland |
| 11 Walter H. Sower | 41 Frederick Terentuk |
| 12 Ian W. Adair | 42 Frank R. Anton |
| 13 Alan A. Cobb | 43 Cyr. E. Chance |
| 14 Brian G. Wilson | 44 Eric M. Dodd |
| 15 John W. Hentz | 45 James B. Hyre |
| 16 Earl F. Guy | 46 Bernia M. Newton |
| 17 Peter Krueger | 47 Alan D. W. Ingham |
| 18 Donald F. McInnis | 48 Robert N. Anderson |
| 19 George M. Self | 49 Andrew L. Doucette |
| 20 David A. Armstrong | 50 Helen B. Stadelbauer |
| 21 George T. Potter | 51 A. E. Davis Schonfield |
| 22 H. Russell McArthur | 52 Priscilla Eccles |
| 23 Henry Zentner | 53 Frieda C. Heyman |
| 24 Stanley Norris | 54 A. Reginald Prince |
| 25 Brigida Steene | 55 Theophilus G. Finn |
| 26 Robert A. M. Shields | 56 M. Harry Scargill |
| 27 John E. L. Peck | 57 Thomas A. Oliver |
| 28 Quentin D. Dnottle | 58 Gordon Nelson |
| 29 Helen M. Wiam | 59 Frank C. Acorn |
| 30 Frank E. Chishley | |



Plate 2.27a Identification Key Plate 2.27a





EXPLOSIVE GROWTH

The arrival of Adam Matthew Neville in July 1963 signalled the start of a period of unprecedented growth in Engineering at Calgary. At the time he was 40 years old, a man in his prime. He brought with him the background of an international scholar with degrees from the University of London and academic and engineering experience from employment at the Universities of Southampton, Manchester, the Canterbury University College in Christchurch and the Ministry of Works of New



Plate 2.29 Presiredent, concrete beam being subjected to live load. The first engineering graduate students at Calgary from left to right: Michael M.W. Staunton, Gordon Andrew Hutchings, Gordon Michael Bonn, Bohavik and Michael Cordo. Autumn, 1963-64 academic year.

Zealand. Before going to Saskatoon as Professor of Concrete Technology he spent a year as Dean of Engineering at the University College, Ibadan, the Nigerian College of Technology, Zaria. Having travelled to and lived in the four corners of the world he had acquaintances, friends and contacts around the globe which were to serve him well in the mammoth recruitment task which lay ahead for Engineering at Calgary.

Adam Neville also brought with him four graduate students and a technician, B. I. Tingley. Within three months he initiated an MSc graduate programme and three graduate courses thereby establishing an emphasis on research which he



G. W. Govier



Mary Christopherson



A. M. Neville

Plate 2.28 The senior Engineering Division staff, Fall, 1963

considered to be an essential ingredient of the activities of university academics, differentiating them from technical or junior college staff. Registrants in those first graduate courses included not only his graduate students but also 19 special students, mostly practising professionals from downtown whose attendance was facilitated by scheduling lectures in late afternoon or evening hours, a custom which became a tradition in the faculty and which has been aided by many visitors including members of an accreditation team.

To replace staff who had resigned or went on leave he hired Messrs. R. E. (Bob) Loov as Assistant Professor of Civ. Engineering, F. W. Linger as Sessional Instructor, and D. W. Pashniak as Assistant Professor of Mechanical Engineering, both for one year. He found a research assis-

stant, Mr. D. J. Martin and appointed him as teaching assistant for the 1963-64 session. After a number of trials he decided on Mrs. Mary Christopherson as his secretary who was to remain Head secretary and become the first Dean's secretary.

It was fortunate that G. W. Govier had moved to Calgary during the early summer of 1963, had been appointed Professor of Engineering (part-time) effective June 1, 1963 and was interested in continuing his involvement in building the Engineering Faculty at Calgary. Here was a man with over two decades of experience in academic administration, planning, teaching and research who had also been active in the profession, serving as Vice President and President of the Association of Professional Engineers of Alberta (APEA), in 1957-58 and 1958-59 respectively. As Chair



Plate 2.30 The first Engineering Building, E Block, under construction (right central area of photograph) Spring, 1964

Creating a Faculty – 1963-1968

man of the Oil and Gas Conservation Board of Alberta he had come to know governmental organizations and personalities and had contacts and connections in industry and in the profession. As it would happen Adam Neville and George Govier saw eye to eye on key issues related to the development of Engineering at Calgary. Thus a close collaboration developed between these two senior academics which became the driving force for the explosive growth experienced in Engineering at Calgary between 1963-1968.

After the undergraduate and graduate programme was successfully launched in the Fall of 1963 (see Fig. 2.4 for enrolment statistics) the new Division Chairman turned his



Fig. 2.3 The new Engineering Building under construction

Stage II. With the advice and help of prepared and submitted a series of George Govier Adam Neville prepared three reports:



Fig. 2.5 The authors of the reports prepared for Stage II development of the Engineering Centre

- *Forecast of Registration and Staff Requirements* January 6, 1964
- *Development of the Engineering Programme* January 7, 1964 and
- *Detailed Proposal for Stage II Development of Engineering Centre* February 24, 1964

attention to the immediate task ahead, namely the first building of the Engineering Centre. The Govier Report had suggested that this building be completed by the Fall of 1963. Construction had not yet begun when he arrived in Calgary. Consequently he energetically and systematically set about trying to get things done at short notice. By May 1963 he had crossed the last hurdle, having exterior elevations, designs and color schemes for the building approved by the Board of Governors. Construction finally got under way in November of that year.

With Stage I of the Centre thus in hand he turned to the next project, namely the preparation of a detailed proposal for the rest of the Engineering Centre, referred to as

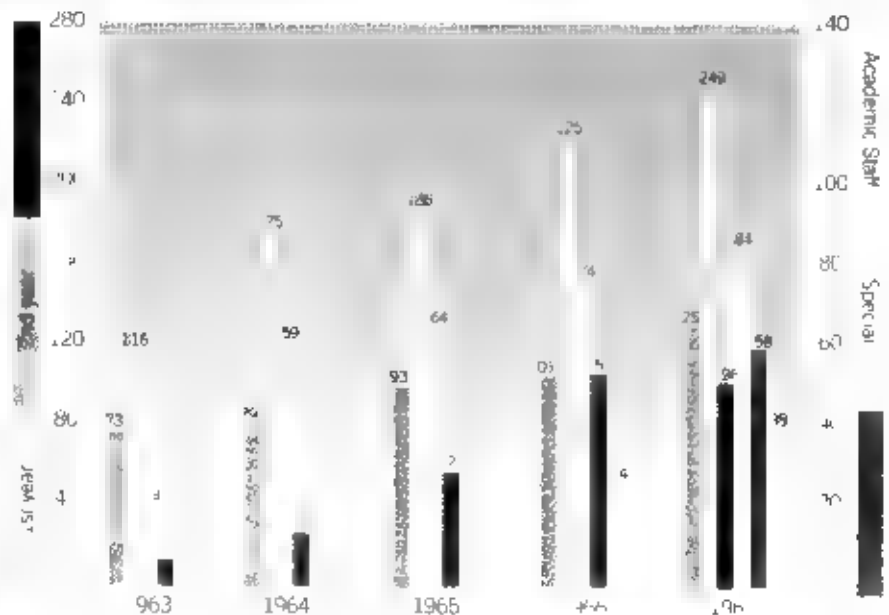
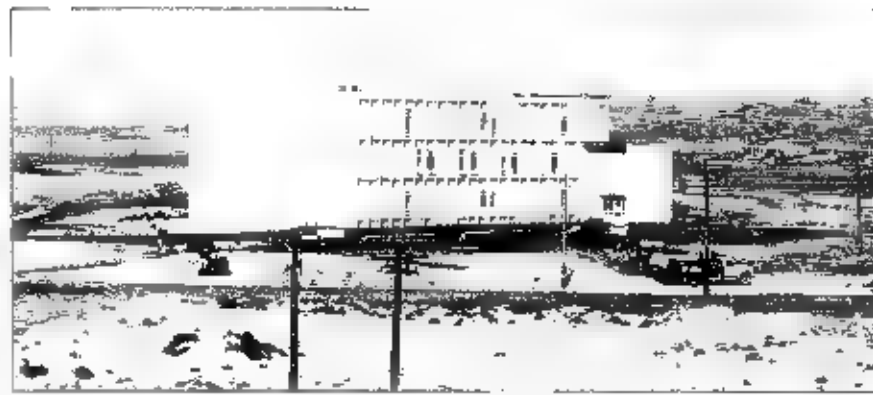


Fig. 2.4 Enrollment and Permanent Academic Staff

The first two reports contained essential registration projections and a suggested structural space requirements. The third Report and subsequent recommendations proposed that the C-Building, D-Building and the E-Lecture Theatres be completed by 1966 with B-Building and the Energy Transfer Laboratory slated for occupancy in the Fall of 1967 and A-Building a year later. This Report with the first two recommendations as Appendices was endorsed by the Campus Planning Committee in Calgary and Edmonton and approved by the Board of Governors permitting commencement of working drawings during September and the Summer of 1964.

The Report also recommended an expense item which would take members of the Division of Engineering on a tour south of the Department of Public Works (DPW) on an architectural tour of a few of the most modern recently completed Engineering facilities in Eastern Canada and the United States. A five man team including H.A.R. de Paiva, G.W. Govier, the Chief Architect of DPW, H.A. Henneron, R.E. Luov and A.M. Neville visited 9 universities between June 10-19, 1964. On the basis of information gained from this tour, the floor framing for buildings in Stage I was changed to moving flexibility in layout and room layouts. In addition, the new curriculum design was also obtained.

The 1964 General Report further recommended that the Engineering



Science and Engineering Building, Summer 1964

Centre and the Faculty at Calgary did not discuss curriculum details. The two senior engineering academics at Calgary were fortunate and in complete agreement on the question of what is important in a Engineering curriculum of the 1960's. The views and specifications for such a programme are summarized in the second report listed above, the essentials of which were also published as a paper (see Appendix D). It was this Neville-Govier curriculum plan which became the basis of the new undergraduate programme at Calgary. It was a curriculum which in some respects was very much in keeping with the emphasis on science and analyticity of the mid-1960's, the height of the *Sputnik* era. It proposed a broad education including a sound background in mathematics and the physical sciences and an understanding of the methods of engineering science and the art of engineering as

well as an appreciation of the significance and the effects of engineering on society and the environment. It was to contain eight terms of six courses with a common core extending over all four years and being totally common for the first two years (see Appendix D). Although its authors referred to their ideas and views in their paper as in no way original or revolutionary, the Neville-Govier curriculum was in its days a daring, innovative and challenging experiment in undergraduate education.

In addition to these administrative and organizational tasks the Chairman of the Division found time to teach and look after his research work. Within a few months he established a new Concrete Research Laboratory in the basement of the Science and Engineering Building. In the Spring of 1964 he was appointed to the Civil Engineering Grants Selection Committee of the National Research Council of Canada (NRC) an appointment which helped to put Engineering at Calgary on the map of Canadian Engineering Schools active in research. He also spent some time on recruitment hiring Mr. Gunnar J. Berg and Dr. J.E. Szymanski as Assistant Professor of Electrical and Mechanical Engineering respectively. He secured the services of Dr. A.H. Anderson and Mr. H.M. McCosker as part-time Specialist Lecturer in Engineering and as Sessional Lecturer in Civil Engineering for one year each respectively. He hired Miss S.M. (Judith) Porter and Miss Maria Fogaras as Research Assistants. In addition after completing his PhD studies, P.G. Gluckner returned from the University of Michigan to resume his duties as Associate Professor of Civil Engineering.



Science and Engineering Building, Summer 1964

Professor McArthur remained at Singapore Teachers College for a further year and Walter Stewart handed in his resignation on September 30, 1964 to take a teaching position at the Trinidad University under the UNESCO Plan.

First year enrolment in the Fall of 1964 increased by approximately 50% with even more dramatic growth experienced in graduate student and special student numbers (see Fig. 2.4). Six new graduate courses were introduced in addition to the three which had been offered the previous year.

The highlight of the late summer and early fall of 1964, however, was the move of Engineering from its home in the Science and Engineering Building to their new home, the E Block. Classes were started in this new building in September which was officially opened on November 25, 1964 (see Plate 2.35).

With the establishment of a General Faculty Council (GFC) and the appointment of Dr. H.S. Armstrong as President of the University of Alberta, Calgary, on July 1, 1964, the Calgary Campus attained academic autonomy. Administrative procedures were modified and changed to take into account this independence. With six full-time and a number of part-time and sessional staff in Engineering the Chairman of the Division established a Committee referred to as the *Engineering Council*, which functioned as a Faculty Council and dealt with academic matters and questions related to the development of the Engineering Centre and the Engineering curriculum. The first meeting of this

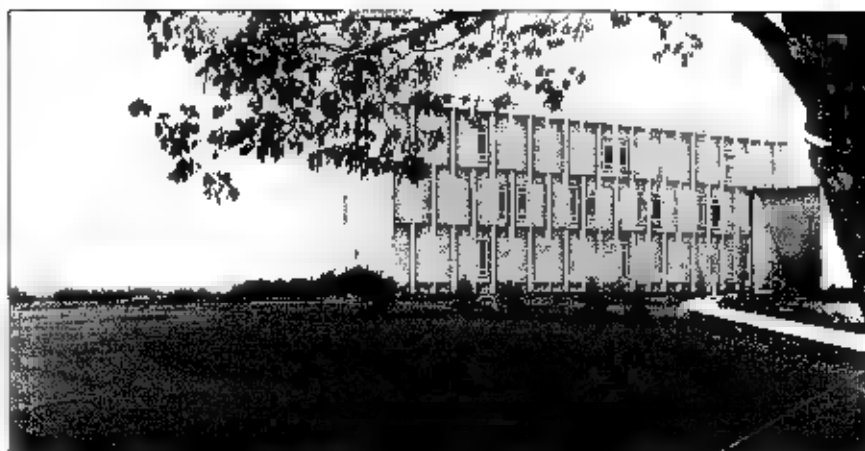


Plate 2.36 The E Block, the Home of Engineering 1964-65

Council was held September 28, 1964 with the following members in attendance: G.J. Berg, C.E. Chalice (Physics), H.A.R. de Pava, P.G. Gockner, G.W. Govier, R.E. Loo, D.L. Mills (Sociology), T.M. Penellum (Dean, Arts and Science), J.E.S. Venart, and A.M. Neville in the Chair. The most substantive item of this first meeting dealt with a request to GFC to recommend to the Board final approval of plans previously approved in principle for the expansion of Engineering education on the Calgary Campus, namely offering of third and fourth year programmes commencing in the Fall of 1967 and 1968 respectively, in Chemical, Civil, Electrical and Mechanical Engineering, and the establishment of a

Faculty of Engineering effective April 1, 1965.

The second meeting of Engineering Council held November 2, 1964 approved the *general aims and specific features* of the Neville Govier undergraduate curriculum plan, thereby making it the cornerstone of the Engineering programme at Calgary (see Appendix D). At the same meeting four committees were established and were charged with



G. J. Berg



D. W. Bannier



A. H. Younger

Plate 2.38 New Chemical Engineering staff 1964-65



Plate 2.39 First Engineering Faculty Council 1964-65. Seated: P.G. Gockner, H.A.R. de Pava, A.M. Neville, T.M. Penellum, J.W. Gregg. Standing: G.W. Govier, R.E. Loo, D.L. Mills, G. J. Berg, J.E.S. Venart, C.E. Chalice. April 26, 1965.

the task of working out details of the first and second year courses for the new programme. In addition to the Engineering academic staff, these committees also included colleagues from the Faculty of Arts and Science, namely Drs. C.E. Chalice and J.R. Prescott from Physics, Dr. P.S. Simony from Geology, Dr. A.S.B. Holand, P. Lancaster and J. Schaer from Mathematics as well as Dr. F.C. Adam from Chemistry. Mr. J.W. Gregg of James A. Lewis Engineering Ltd., the first APEA representative on Council, also served on a number of committees. The committees reported to Council on November 23.

1964 when eight courses from the Committee on Math and Engineering, four courses from the Mathematics Committee, three courses on Mechanics and a course in Geology were approved. At the same meeting a Committee was established for bringing forth courses to the Humanities and Social Science electives. In December Council gave final approval to the first and second year Engineering curriculum and also approved 8 new graduate courses, bringing the total number of such courses to 17.

In February the Chairman informed Council that GFU had approved the new Engineering program for first and second year, but that 15 week



A. J. Jones



B. B. H. Jones



John C. McPherson



B. W. Jones



M. A. Jones

terms recommended by Council were approved only for Engineering courses and were to start in the Fall of 1966. This decision put engineering courses out of step with all other 15 week courses, including the non-engineering content of our new curriculum and ultimately led to the elimination of the 15 week terms in engineering. On April 1, 1965 Engineering in Calgary joined Faculty units with

A. M. Neville being appointed the first Dean, H. A. R. de Paiva Administrative Assistant to the Dean and Mary Christopherson the first Dean's secretary. The first meeting of the Engineering Faculty Council (EFC) in Calgary which would have been the ninth meeting of the Engineering Council, was held Monday April 26, 1965 with the membership of the new council being identical to that of



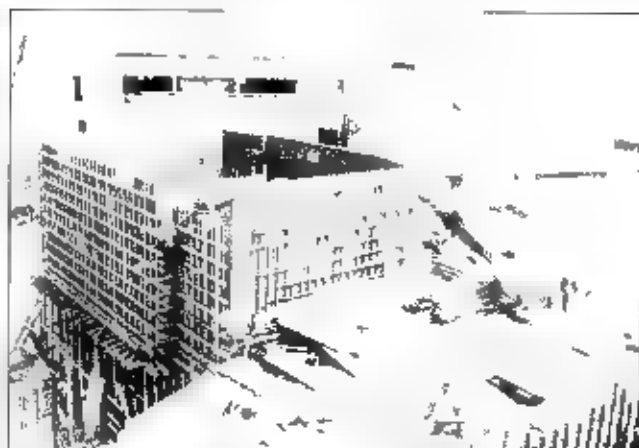
Aerial view of the University of Alberta campus.



Aerial view of the University of Alberta campus, showing the main building and surrounding area.



Aerial view of the University of Alberta campus, showing the main building and surrounding area.



Aerial view of the University of Alberta campus, showing the main building and surrounding area.

Aerial view of the University of Alberta campus, showing the main building and surrounding area.



Plate 2.41 Dean A.M. Neville after crowning the Engineering Queen, Miss Anne Mawson. 3rd year BEs was rewarded with Her Majesty's sash during the ceremony on November 20, 1965.

its predecessor organization (see Plate 2.37). At the same first meeting, Council approved a programme for a Post-graduate Diploma in Engineering.

Having completed his PhD studies at Purdue, A.G. Doige returned in May

1965 to resume his duties as Associate Professor of Mechanical Engineering. During the Spring and Summer of 1965 Dean Neville continued his recruitment bringing on board Drs. Khalid Aziz and D.W. Bennion as Assistant Professors of Chemical Engineering, Dr. Amin Ghali as Associate Professor of Civ. Engineering, Drs. Brian B. Hope and M.A. Ward as Assistant Professors of Civ. Engineering, and Mr. J.C. Webber as Sessional Lecturer in Civ. Engineering. The Fall of 1965 also saw the first full time teaching female academic staff member in Engineering at Calgary, Dr. Switlana Winnikow, Assistant Professor of Mechanical Engineering. Mr. Brian W. Langan was appointed Research Assistant in Civ. Engineering at the same time. Professor H.R. McArthur remained on leave of absence in Trinidad returning to Calgary in the Spring of 1966 and resigning from the Faculty effective August 31, 1966.

Initiation of the first year of the new curriculum in the Fall of 1965 attracted a record number of students with the second year group being the last one to proceed to another campus for completion of their undergraduate education. There were 24 MSc, 3 PhD and 64 special students enrolled in graduate courses in Engineering that fall (see Fig. 2.4).

During the 1965-66 Session, curriculum committees were established by EFC to design detailed course outlines for the third and fourth year pro-



Plate 2.43 Dr. A.M. Neville in audience with Her Majesty the Queen Mother after receiving a DSc from the University of London, May 2, 1966.

grammes in Chemical, Civ. and Mechanical Engineering. Since G.J. Berg was the only Electrical Engineer on staff, the development of the Electrical



Harvie A. Milne



R.A. Rittle

Plate 2.44 New Chemical Engineering staff 1966

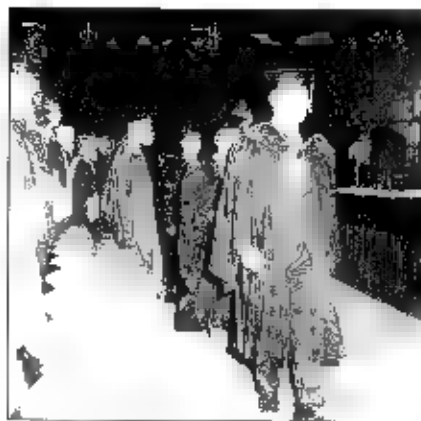
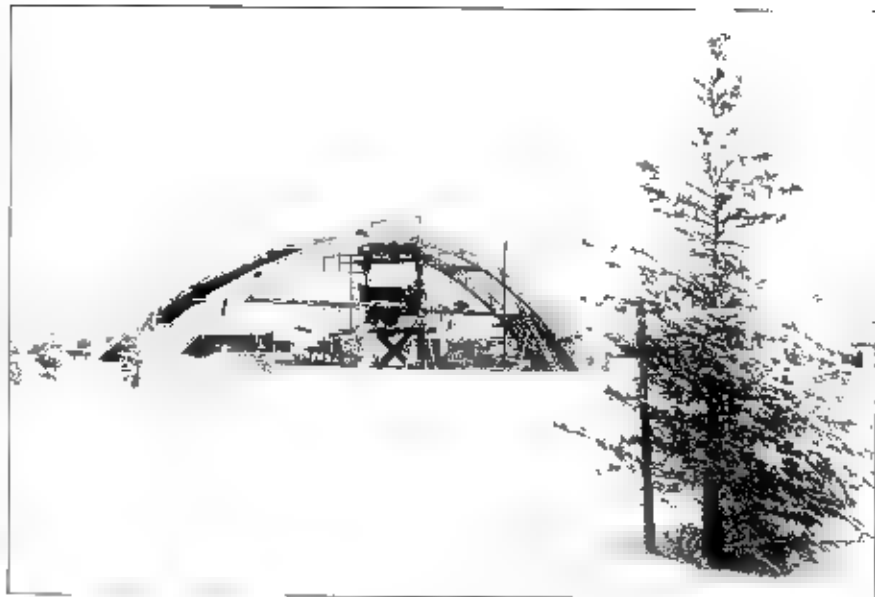
Engineering programme was delayed. MSc programmes in Civil Engineering were expanded and were offered for the first time in Chemical and Mechanical Engineering with six new graduate courses approved by Council. On November 2, 1965 H.A.R. de Paiva was appointed the first Assistant Dean of the Faculty of Engineering.

Final approval for the new third and fourth year curriculum for Chemical, Civ. and Mechanical Engineering was given at the sixth EFC meeting on December 15, 1965 with the Electrical Engineering programme approved in principle. It was agreed to recommend to GFC the establishment of four departments effective July 1, 1966. To look after the first and second year students and a



Plate 2.42 W. Barry Leslie (CE BSc by MSc) taking the notable air photo of the BSc '69 during Survey School, early May, 1966, view towards East D Block and E Lecture Theatres under construction.

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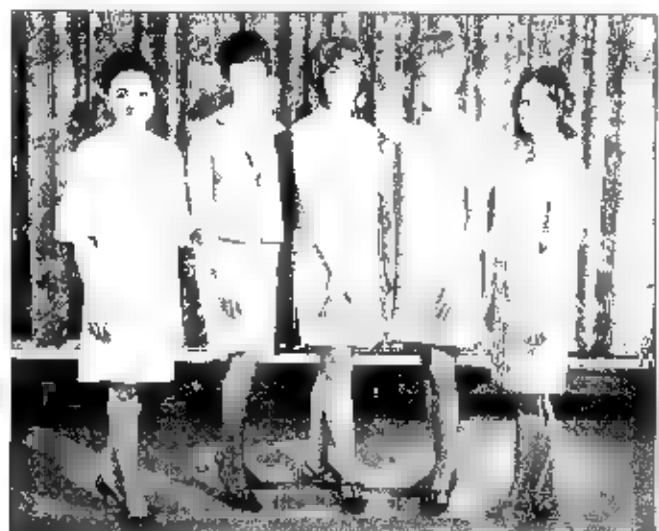
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On 366 Dean Newell presided at a luncheon in the cafeteria and sat around the table with Mr. Robert G. Ald and Drs. Harvie Andre and R.A. Rier. Also present were Associate Professor and Professor and Head of Chemical Engineering, respectively Dr. L.H. Wiley and Mr. Ronald H. Mills. Assistant Professors of Civil Engineering, Drs. D. Comer and F.N. Trovati; Associate Professors and Gordon S. Hope, Assistant Professor of Electrical Engineering, Drs.

T. K. G. Goves and D. H. Norris are Associate Professor and Professor and Head of Mechanical Engineering respectively, and D. Walter Dörfler is Professional Associate in Civil Engineering.

With the passing of the new Act in the Spring of 1966, the University of Alberta-Calgary became The University of Calgary with its own Board of Governors and Senate. A Council of the University was also established.


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$$f_1^2 \in \mathcal{H}_1^2 \quad \text{and} \quad f_2^2 \in \mathcal{H}_2^2 \quad \text{with} \quad f_1^2 + f_2^2 = f^2 \quad \text{and} \quad f_1^2 \perp f_2^2 \quad (4.1)$$

and consequently what would have been the tenth meeting of EFC became the first meeting of the reconstituted Engineering Faculty Council on August 22, 1966. It was at this Council meeting that a new graduate programme and degree, the MENG was approved with the same course requirements as the MSc but without experience requirement and a variation based on a design project.

During the summer of 1966 the C and D Blocks and the Electrical Theatres were completed adding approximately 10,000 m² (100,000 ft²) of new floor space to the Engineering Complex at a total cost of \$2.7 million. The Dean with his assistant and secretarial staff and Student Affairs moved into the C Block while Chemical and Mechanical Engineering



Figure 2.5 The new Engineering Department lecture hall at the University of Alberta, 1966.



T. H. Clarke



L. H. MacIntyre

Figure 2.6 Faculty of Engineering, 1966.



D. H. Trofimenko



R. H. Munn



W. H. Miller

Figure 2.7 Faculty of Engineering, 1966.

academically supported a move into the new D-Block for relocation of the Mechanical Engineering wing and the Energy Transfer Laboratory was started during that summer.

Undergraduate, graduate and special student registrations increased once again in the Fall of 1966 (see Fig. 2.4) which saw the inauguration of the new second year Engineering programme. There were four girls in first year: Gillian O'wynne Clark, Sandra Goodwin, Barbara Jean Matthiesen and Germaine S. Spring, the first time that the number of female students in any Engineering class in Calgary exceeded one. At the EFC meeting on October 4, 1966 the Electrical Engineering programme was approved thus completing the curriculum design for the new Engineering programme in all four disciplines.

In the fall of 1966 the Alberta government and the petroleum and natural gas industry agreed to establish the Petroleum Recovery Research

Centre (PRRC) which was to be on the campus. The newly completed D-Block Dr. Fredrick A. Nick Mungai was appointed as its Chief Research Officer and Head in November of that year.

On January 1, 1967 R. H. Munn replaced A. M. Neville as Head of the Department of Civil Engineering while F. N. Trofimenko was appointed Acting Head of Electrical Engineering, effective April 1, 1967, an appointment which was changed to Head of the Department on October 1, 1966.

In accordance with original policy established by Faculty Council, the first and second year programmes were to be reviewed after two years of operation. Consequently a Committee was established at the fourth meeting of EFC on November 1966 with G. W. Govier as Chairman. It was to look at the first and second year programme and try to find answers to and possible remedies for the difficulties the students were experiencing

with the curriculum, as evidenced by the high attrition rates, especially in first year. After an extensive review of the courses taken by engineering freshmen and sophomores, the Committee reported to Council in April/May of 1967. On the basis of its review, the Committee concluded that there was too much content in a number of the first and second year courses. It



Figure 2.8 Patricia Bickmaster, President and Past Bickmaster, making a presentation to the representative of the University of Alberta, during the inauguration of the University of Alberta, 1966. Patricia Bickmaster, President of the University of Alberta, 1966, was the first woman to hold the position. Patricia Bickmaster, President of the University of Alberta, 1966, was the first woman to hold the position. Patricia Bickmaster, President of the University of Alberta, 1966, was the first woman to hold the position.

her, mentioned removal of some material and a redesign of the other objects from introductory to more advanced courses. This began the revision process of the new curriculum which was in compliance with instructions at the present 1994

Dr. Newell and the Delta Phi Epsilon Heads succeeded in hiring another group of academics to join the original departments during the Spring and Summer of 1967 (see also see Chapters 1-4).

The Engineering Reading Room
Library was established on July 1



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Plate 2.53 H.A.R. de Paiva & C.F. Rod & Dorothy de Paiva, Ada & Mary Neville the Dean exhibiting the just as was presented with by Mike Ward



The Dynamic Duo as the Governor Governor Adam Neville & Governoress Lady Neville



Plate 2.54 R. Ramzy Zaghloul, Mary Christopherson, Dorothy & Rod de Paiva, Mike & Joan Ward, Susan de Paiva

Plate 2.55 Sentimental farewell party for the Nevilles - Spring 1967 at the Calgary Petroleum Club

Dean A.M. Neville went on sabbatical leave to the University of Leeds. H.A.R. de Paiva became acting Dean with J.E.S. Venart serving as Assistant Dean of Engineering.



Plate 2.56 A.M. Neville, H.A.R. de Paiva, J.E.S. Venart receiving the \$500 Scholarship from Mr. Keith Thompson, Executive Vice President, Managing Director of Canadian Cities & Petroleum Corp. with Assistant Dean Dr. H.A.R. de Paiva representing the Faculty February 1967

In August 1967 the Mechanical Engineering wing and the Energy Transfer Laboratory were ready for occupancy. The Mechanical and most of the Electrical Engineering staff moved into this new wing from the D and E Blocks respectively. Construction on the Electrical Engineering wing was started in early Fall of that year. The first stage of the hybrid computer was installed in the new Energy Transfer Laboratory (see Plate 2.56) and the Sub-Station of the University Data Center was established with an IBM 1130 computer.

The Fall 1967 first and second year enrolments stood at 249 and 125 respectively with 96 students forming the inaugural third year class of the new Engineering programme including 23 students in each of Chemical, Civil and Mechanical and 27 students in Electrical Engineering. Graduate work and research con-

tinued to mushroom with PhD, MSc and MEng programmes in place and approved and with *carte blanche* PhD programmes for Electrical Engineering approved a few months later.

At the October 3, 1967 meeting of EFC, Acting Dean de Paiva thanked Mary Christopherson for her contributions to the Faculty on her resignation and imminent departure from Calgary and introduced Maureen Novak as her successor in the Dean's Office.

A PhD student Mr. Mohammad Akram Sheikh supervised by H.A.R. de Paiva became the first doctorate graduate of our Faculty at the Fall 1967 convocation. At the March 13, 1968 meeting of EFC, the degree designation *with distinction* was approved for graduates in Engineering who obtained a GPA greater than or equal to 7.6 (out of a maximum of 8.0) over the last two years of their study while carrying a full programme.

One of the last acts of the Dean was the submission of a report entitled *Proposal for Stage II Development of the Engineering Complex*, dated March 7, 1967, in which he recommended the construction of extensions to the Civil and Chemical Engineering Blocks, ready for occupancy by 1969 and 1971 respectively. The report prepared by a Faculty Committee under the chairmanship of D.H. Clyde, used enrolment projections based on the explosive growth of undergraduate and graduate registrations during the mid-1960's which turned out to be over-optimistic. The Civil Engineering addition was finally built and completed in 1982 while the Chemical Engineering extensions await realization.

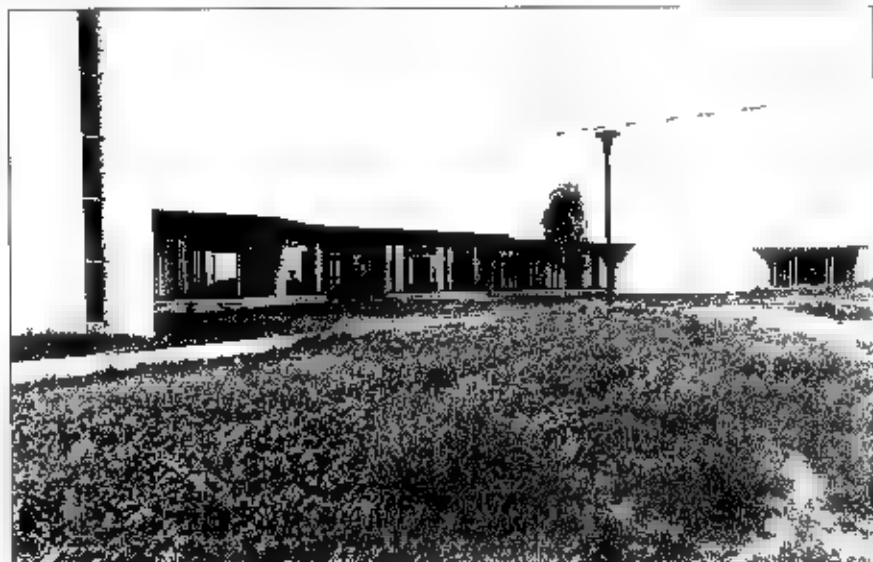


Plate 2.57 View looking at the Engineering Courtyard view towards NW - 1967-68



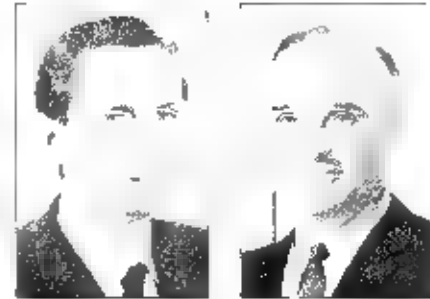


Plate 1. View of the Engineering Courtyard during the 170th Anniversary

STABILIZATION AND CONSOLIDATION

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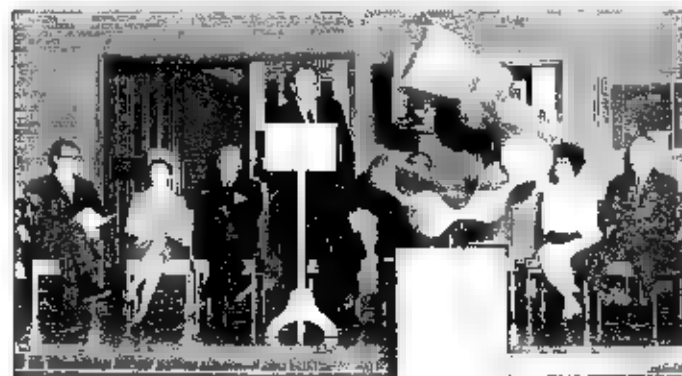
of growth in the peritoneal cavity. In males, the fat of 1968 and the area and gradient of the fat in 1969 were significantly different from those in 1968. In females, however, we observed no significant differences (see Fig. 2.5).



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Building a Name: 1968-1975

For the first time there were 87 seniors in the Faculty: 21 in each of Chemical and Civil, 25 in Electrical and 20 in Mechanical Engineering. Respectively. In the Spring of 1969 8 of them received their BSc degrees from Dean Ritter on convocation day May 26. At the same convocation Bob Ritter awarded the Howard W. C. Fellowship to E. T. Subramaniam (CE).

Fourteen new academics started in the Fall of 1968 while 5 resigned and had left. With 95 full-time graduate students and \$530,000 external funding, research activities of the staff continued to grow rapidly.

The Electrical Engineering Wing (A Block) was completed in late Summer of 1968 thus bringing to a close the Stage I development of the complex. Dean Ritter actively supervised the extensions to Civil Engineering and Chemical Engineering, proposed by Dean Neville prior to his departure in the Spring of 1967. There was, apparently, no time for an anniversary to mark the completion and opening of the Engineering Centre. There was, however, a ceremony held in the main foyer of the Engineering Complex on May 27, 1968 in connection with the cen-



Left to right: Mr. A. J. G. (Chairman of the Board), Mr. M. A. (President of the University), and Mr. M. A. (Dean of the Faculty of Engineering).

ennial presentation of a sculpture to the Faculty by the Engineering Institute of Canada. The sculpture was a gift from the Government of Canada. The Chairman of the Board and the President of the University, as well as a large crowd were in attendance. The occasion may well be considered an

important event in the Engineering Centre's history without the usual ribbon-cutting with Plates 2.60 & 2.91.

EFC established a special committee to review first and second year programmes. In particular, the first year mathematics courses MATH 207 and 209 with 5 lecture hours per week were too demanding for the student and the lecturer. At the November 5, 1968 meeting of Council the weekly lecture hours in these two courses were decreased from 5 to 4 with appropriate modification of course content. At the December meeting an exchange seminar series between the Faculties of Engineering at Edmonton and Calgary was suggested and the writer was asked to coordinate the series. By Spring 1969 a seminar series was in place with 10 students from each institution working during the first year. The series was successful and was extended to include the offering of full graduate courses.

EFC approved and asked the Dean to strike new DC's for Faculty Services and for Environmental Engineering at its January and March 1969 meetings, respectively. At the May 1969 meeting the length of

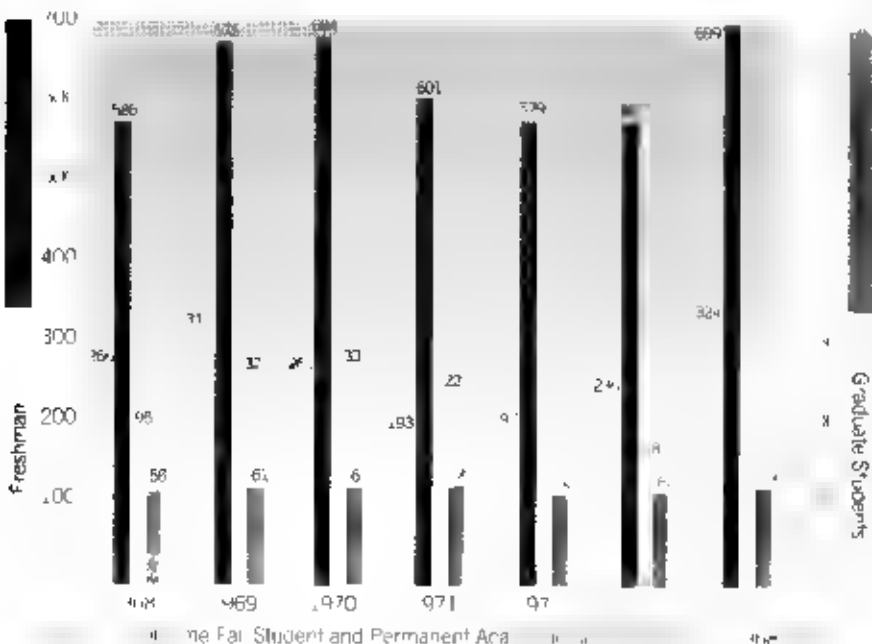


Figure 1: Freshman Student and Permanent Academic Staff



Plate 40 - Looking North Ritters see an open office and a professor's office with a large window. The building is a large, modern building with a prominent central tower and a long, low wing. It was fondly referred to by many as Ritters Fountain.

The number of full time academic staff also remained constant but support staff had to be reduced.

The question of 75 minute lectures for Tuesdays and Thursdays which had been discussed and rejected by Council in January of 1970 was brought back and was approved in January 1971. Student teaching evaluations were also approved at the same meeting.

In addition to teaching and research the academic staff hoped to establish the name of the young Faculty by

organizing national and international conferences at Calgary. One of the highlights of the 1970-71 academic year was the hosting by the Faculty of Engineering and The University of Calgary of the Third Canadian Congress of Applied Mechanics (CAM). CAM Calgary, planned and organized by the Organizing Committee under the chairmanship of the writer (see Plate 2-69). Other conferences hosted by the University and the Faculty include the Int. Union of Theoretical and Applied Mechanics Symposium May 12-14, 1972, orga-

nized by Dr. M.F. Mohtadi and co-sponsored by PRR. The conference on *Multi-variable Control Systems* organized by Dr. M.H. Hamza under the auspices of the Int. Federation of Automatic Control and the 1st Canadian Int. Assoc. for Steel Structures Conference July 3-6, 1972 organized by the writer.

Undergraduate enrollment in the Fall of 1971 decreased by 8% from the 1970 figures (see Fig. 2-5). At the October 28, 1971 Council Meeting the Deans' List was not

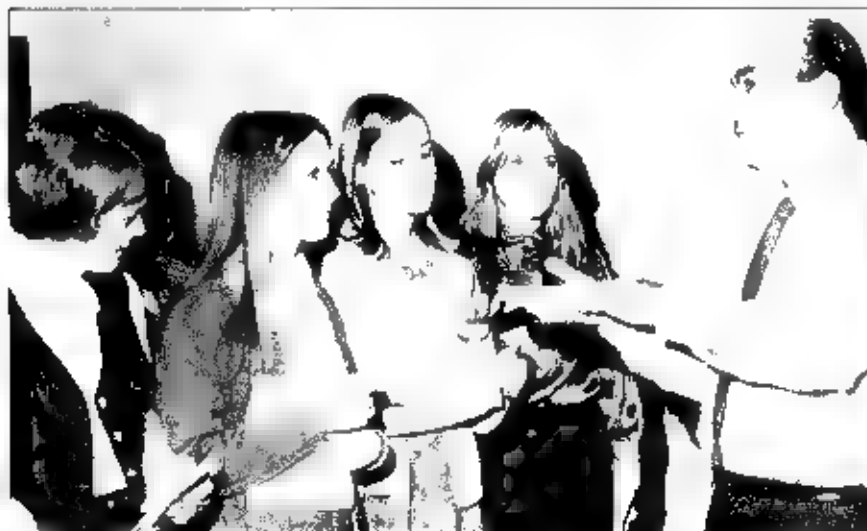


Plate 41 - Dr. Ann Mitchell Head of the Faculty of Engineering, University of Calgary, with four students. The students are Maggie, Mary, and two others. They are all looking at a document or book that the man is holding.

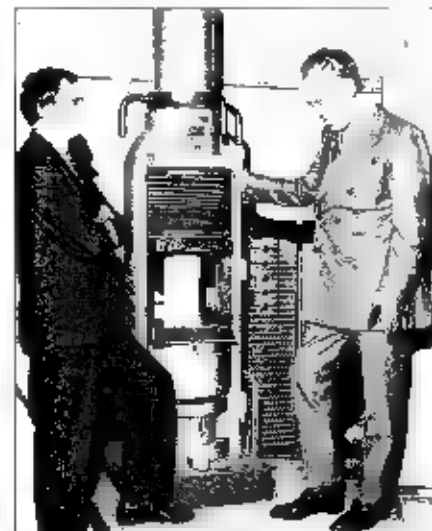


Plate 42 - Dr. M.A. Ward and Dr. M. J. Edwards. They are standing next to a large, industrial-looking machine. One man is pointing at the machine while the other looks on.

ated for students who obtain a grade point average (GPA) greater than or equal to 3.6 during the preceding academic year.

Even though graduate student numbers continued to rise, the decrease in undergraduate student numbers, coupled with the tightening of funding from the government, resulted in further budget cuts for the Faculty which were announced to be *disastrous* by the Dean at the January 14, 1972 EFC meeting.

There were other problems Dean Ritter had to cope with. Rod de Paiva, who had been appointed

Head of Civil Engineering after the resignation and departure of Ron Morrison. July 1969 was selected Acting Vice-President Capital Resources. In November 1970, and Peter Glorner was appointed Acting Head of Civil Engineering. Ricardo Pava's appointment was subsequently confirmed as vice President Services, a position which he held until 1985. In Mechanical Engineering Doug Norrie was appointed Director of Information Services, effective September 1971 and G.A. Karim became Acting Head for a year. Matt Montad's resignation and Fred Trottenkott's sabbatical re-



A E McMullen



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Plate 208 *Scilla maritima* "Siberica"
Affairs 4

quered appointment of Acting Heads also in Chemical (E. C. Toulson, and



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very old. Prn. F. A. B. D. D. H. W.
M. H. A. J. S. E. G. H. E. R. I. N. G. & U. S. T. A. T. E. I. N.
Prn. A. P. H. E. R. I. K. U. I. & D. e. p. t. u. C. h. a. r. g.
J. e. e. n. g. B. C.

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Dr. R. S. Ryan, Lehigh University
Bethlehem, Pa. Hillary Wick and Prof. F. P.
R. Ryan, Lehigh University, Bethlehem, Pa.
Dept. of Mechanical Engineering, Lehigh University
Bethlehem, Pa.



o Exemplo de Motivos de Defesa e as
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P.L. John & Mrs. Evans. n.º 1. 1970.



Cambridge with Prof. Werner Goldsmith (R
b. 1914, d. 1984, for photo and bio. Address:
The Early Days of Aeronautics, 7 Newbury
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CONTROLLED GROWTH AND CONSTRAINT

Dr T.H. Barton joined the Faculty of Engineering on July 1, 1975. He came from McGill University where he had been a member of the Electrical Engineering Department since 1957, serving as Associate Dean (Academic) during his last three years at that Institution. Prior to moving to this side of the Atlantic he was Lecturer at the University of Sheffield for six years. Thus, he had spent 24 years in university teaching, research and administration before coming to The U.C. experience which was to serve him well in guiding the fortunes of the Faculty during the decade 1975-1985. This was particularly true since he was not the only new senior administrator in the Faculty office. Dr E.W. (Eric) Johnson (ME) had just been appointed Assistant Dean after Alan Tory's term had expired. Eric Johnson continued to be responsible for Student Affairs in Engineering for the next 10 years. Dr R.A. (Dick) Stein (EE) had been looking after the common core as Acting Head of Common Curriculum only since the beginning of the year, therefore also relatively new at the job.

One of the first changes the new Dean instituted was to rename the Assistant Dean's position to Associate Dean (Student Affairs) and to create a position of Associate Dean (Academic) with responsibilities



H.



E.W. Johnson



R.A. Stein



O.P. Malik

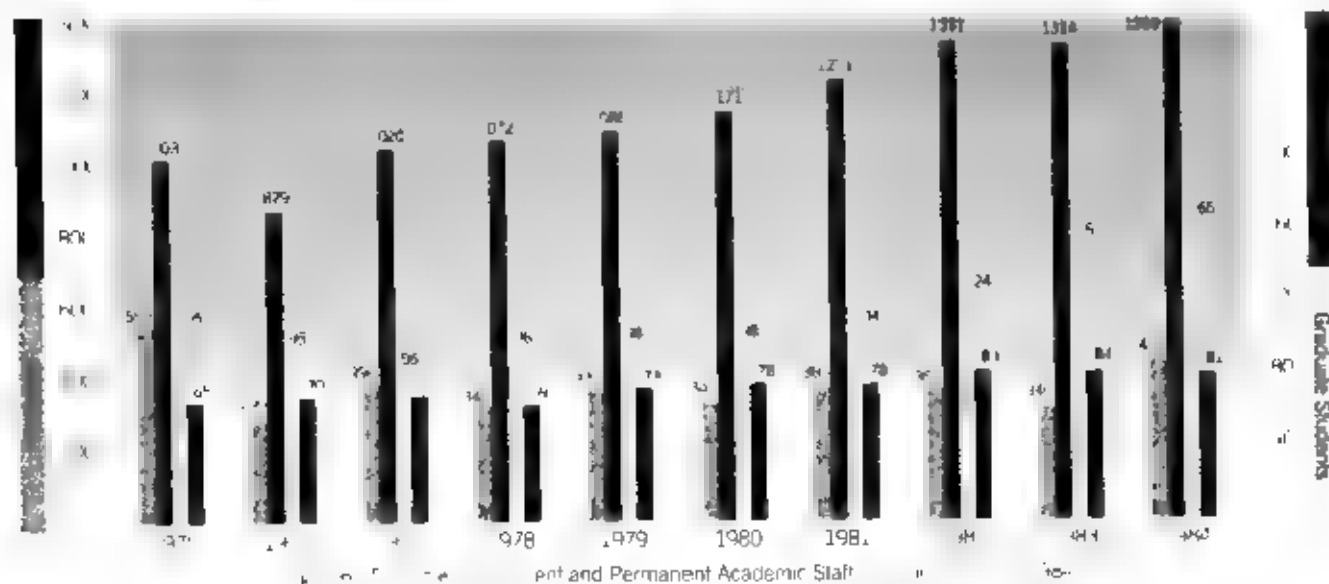
Senior Engineering administrators in 1975. O.P. Malik succeeded Dick Stein in 1979.

including those of the Head of Common Curriculum, effective September 1, 1975. Soon after his arrival he confirmed Dick Stein's appointment until June 30, 1979.

The Fall of 1975 saw the introduction of the S system of units in accordance with the May 1975 EFC decision. The biggest surprise to both staff and students that Fall, however, was the unexpectedly large first year enrolment which had rocketed to 580 students in September as compared to 324 on December 1 of the previous year (see Fig. 2.6). Almost half of this huge class were visa students from Hong Kong many of whom had rather poor facility in the use of English. Tom Barton was facing his first *min. crisis*. The physical facilities, the academic and support staff complement, the number and size of sections for first year groups, were all totally inadequate for such a huge enrolment.

Fortunately, contingency funding was made available to hire additional sessional staff. The *space problem* which had progressively deteriorated during the early 1970's, was turned into a real *space crunch* overnight, to which there was no easy quick solution, particularly since a *moratorium* was imposed on all new capital construction by the Provincial Government a few months later. The Dean announced this *freeze* at the January 13, 1976 EFC meeting when he guestimated that it would likely delay the Civil Engineering building by some 3-4 years. He also questioned whether the Faculty could continue to afford the Owl's Nest as a Faculty Lounge in view of its minimal use by both academic and support staff.

It was clear to everyone in the Faculty that a repetition of the 1975



Maintaining Quality – 1975-1985

first year enrolment could not be accommodated. Consequently the Dean suggested (EFC October 1975) and Council approved (February 1976) an enrolment limit for first year Engineering of 350 students, with visa student numbers limited to 50. Following the action of a number of other Western Canadian universities, demonstration of competence in the use of the English language as an admission requirement was finally also introduced at The U of C in 1976 which decreased the number of first year visa students in Engineering from 243 on December 1, 1975 to 41 on the corresponding date in 1976. The enrolment limit was reaffirmed (February 1977 EFC) was increased to 400 students for first year and was extended to second year with a 350 student quota. In December 1978, the latter providing control of admission of students with advanced credit from the Faculty of General Studies (formerly University College), the Institute of Technology and the junior colleges in Southern Alberta. These quotas were established in cognizance of the Faculty's increased third year enrolment capacity due to the planned introduction of a new Surveying Engineering programme in the Fall of 1979. They have been in effect since then and have allowed efficient and



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effective control of undergraduate student numbers in Engineering

With his first crisis behind him, Tom Barton turned his attention to the *space problem*. He recognized that the huge first year class of '75 transformed this Faculty from a small Engineering School with total undergraduate enrollment of approximately 600 into a mid-sized Engineering Faculty with undergraduate registrants in excess of 1000. Except for a

slight decrease in total student numbers the following year (see Fig. 2.6, undergraduate registration in Engineering was to stay above the 1000 mark, increasing to 1400 by the end of Tom Barton's tenure as Dean. In view of the freeze on new construction, he decided to try to provide some relief to the space crunch with the available resources. Fortunately funds for capital renovations were set to be had. His first reconstruction project was the Faculty office. Realizing that Student Affairs could not continue to operate with its environment with the sudden huge increase in student numbers, he converted the conference room, a small office and a xeroxing room into space for Student Affairs. The interior offices were removed thereby creating a pleasant spacious central area. To provide relief to the over-crowded student study areas, he had two dozen study carrels installed during his first year in office on the main and second floor of the Central Engineering Foyer. In 1978-79 he had the graduate student lounge renovated into an undergraduate study area accommodating 36 additional carrels. A new Food Services outlet was constructed at the south end of the undergraduate student lounge and three dozen additional study carrels were installed in



Ms. J. Miss Lois E. Pow, first year student to be awarded the J. M. Pow Award for the year 1964. Mr. John D. M. Pow, Ass. Manager of the Region of G.M. Representing the students of the year 1964. Ms. J. Miss Lois E. Pow, first year student to be awarded the J. M. Pow Award for the year 1964. Mr. John D. M. Pow, Ass. Manager of the Region of G.M. Representing the students of the year 1964. Ms. J. Miss Lois E. Pow, first year student to be awarded the J. M. Pow Award for the year 1964. Mr. John D. M. Pow, Ass. Manager of the Region of G.M. Representing the students of the year 1964.

the larger floor of the A-Block during 1979-80.

At his very first EFC meeting (75/09/15), Tom Barton announced his intention to dispose of the total energy system at a convenient and opportune time and to phase out the Hybrid Computer System at the earliest possible date. By the Summer of 1978 he had succeeded in his first goal and had converted the area vacated by the total energy system into Chemical Engineering research space. Chemical Engineering was to be moved there when in late Feb of 1979 the Petroleum Research Recovery Institute (PRR), which had occupied the third floor of the D-Block since January 1967, moved into its new environment in the University Research Park. One of the last renovations undertaken by Jean Barton was the conversion of the Owl's Nest (the staff lounge) into space for Student Affairs during the Summer of 1983 thereby, finally providing the appropriate physical facility for the administration of the increasingly large undergraduate enrolment.

The major capital development and one of the highlights of Tom Barton's Deanship was the construction of the new Civil Engineering (F) Wing be-



tween 1980-1982. The realization of this addition to the complex during the tenure on a new capital construction project which seemed formerly unattainable at the time, was a great accomplishment the credit for which must go primarily to Dr. M.A. Mearns Ward, the then Head of the Department of Civil Engineering. In his wisdom he made the approval and construction of a new Civil Engineering Block a condition to the approval and implementation of the

proposed new Surveying Engineering programme which was initiated from within and led to strong support in the Western Canadian Surveying professions as well as the oil industry, the former being an essential service component of the latter. The initiation of the Surveying Engineering programme proposal details of its development and the events leading up to the submission and approval of that proposal, together with the proposal for the Civil Engineering extension forms a veritable Canadian story some of which are summarized in Appendix 1 and in the chapter for Surveying Engineering, Chapter VI. The F-Block officially opened on November 8, 1982 (see Plate 2.79) provides new space for Civil Engineering and also helped to relieve the faculty space problem somewhat.

After a decrease in 1976 total undergraduate enrolment was back to 10,000 by Dec. 1, 1977 with a year class size of 396 (see Fig. 2.6). Fortunately, graduate student numbers stayed fairly static until the early 1980s when increasing demand for research space for graduate students remained constant. Of the staff in 1977 saw a change in administrative staff in Student Affairs when Mrs. Pamela Parr succeeded Gerry Dyer, who had been Administrative Assistant to the Assistant Dean since 1972 after the departure of Elma Krbavac (nee Scott). Pamela Parr continued in that position until 1994.

In addition to trying to find solutions



Figure 2.79: The new Civil Engineering (F) Wing, opened in November 1982. The building is a large, modern structure with a prominent entrance and a series of windows. The photograph shows the building from a low angle, emphasizing its height and architectural details.

to the space problem, the Dean was addressing a number of other problems. His terms of reference at the time of his appointment were:) to reduce the high attrition rate and) to loosen up the rigid academic structure. Since the failure rate was highest in the first year he suggested and Faculty Council requested (May 1976) the Academic Review Committee (ARC) to undertake a broad review of the first two years of the programme. ARC under the chairmanship of Dick Stein with a number of ad-hoc subcommittees studied this portion of the curriculum, surveyed all alumni and reported back to Council in June and in September 1977. The Committee recommended retention of the common core and the total commonality of the first two years, reduction in the first year load by reducing the number of courses in each of the first two terms from 6 to 5, revision of the liberal studies electives and introduction of technical electives in the senior years of all departmental curricula. These recommendations were approved (EFC 77/09/29) thereby eliminating a number of second year courses, combining courses into a single course and forcing a review and revision of the third and fourth year programmes. The revised first year programme was implemented in 1978 with the old second year programme offered for the last time in 1979. Implementation of the revised third and fourth year



Plate 2.77 Thirty six study carrels were installed in 1979-80 in the A Block Foyer

programmes was completed by 1981, some 5 years after the review was initiated.

Programme flexibility was introduced by offering selected first and second year courses in both terms thereby making the programme more responsive to the needs of students who for one reason or another are out of step with the normal academic progression or who wish to start their engineering education in January rather than in September. This increased flexibility was achieved without substantial additional resources since the size of the first and second year classes normally required sectioning in any event. It was Dr. O.P. (Om) Malik who recognized this fact and championed

the offering of first and second year courses in both terms during his tenure as Associate Dean (Academic) July 1, 1979 till December 31, 1990. It was also largely due to the efforts of Om Malik that substantial progress was achieved on relaxing the rigidity of the academic regulations governing degree requirements, student performance assessment and promotion. The regulations were simplified and clarified so as to reduce the number of special and borderline cases which used to require marathon sessions of EFC. The length of time for completion of a degree requirements was increased from 6 to 8 calendar years, a provision which allowed part-time undergraduate study and self-directed co-op programmes thereby giving a growing number of undergraduates the opportunity to continue their employment while pursuing an engineering education. With the increased flexibility in the programme, a reduced first year load and relaxed academic regulations, the student was able to proceed at his or her own pace and was given a fair chance to overcome any set back. The changes resulted in reduced attrition rates which were close to the national average in a common curriculum which was of a reasonable size and in a programme in which the student could select technical electives in specializations of his/her choice.

Other significant developments and events of interest during the period under review include:

- Dr. R.G. (Gordon) Moore, ChE, was designated Master Teacher of the year for 1975-76 by the



Plate 2.78 A new Food Services Counter was installed at the south end of the Engineering Student Lounge, below the E Lecture Theatres, in 1979-80. Due to its convenient location for students, this station is one of the more popular food dispensaries on campus. Shown here is Bob Loov (CE) paying for his lunch with Janet Beddard at the cash register. Sept. 9, 1991.

Students Union in the same year Dr. John Kenda (EE) was named winner of the American Society for Engineering Education (ASEE) Pacific Northwest Section West-
 Coast Excellence Award for Excellence in Teaching

- The Computer Modeling Group, CEM, was established in 1977 with Dr. Kenda as its first director. The group was active for three years and closed on July 1, 1977.
- A course work only Masters program in Mechanical Engineering was approved in time for inclusion in the 1980-81 calendar.
- At the June 1978 EFC meeting 5

of the Inter Departmental Committees (DC's) submitted their intention to disband with only the DC on Solid Mechanics and Faculty services remaining in good health.

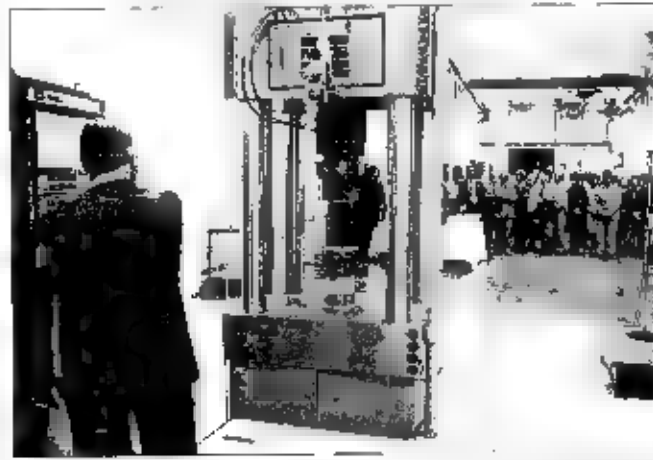
- At the October 1978 meeting of EFC the Dean announced that Mr. Howard Lowe of Billings, Montana had donated \$40,000 to the Engineering Reading Room and that Mr. Lowe's intention was to make further donations of approximately the same size for a number of years. He subsequently donated securities to the University which were sold, the receipts from which were used to

establish an endowment of approximately \$60,000 which provides annual funding for the operation of the Reading Room.

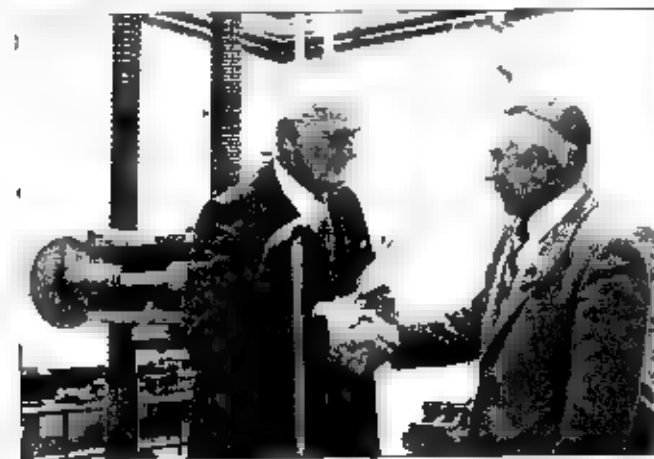
- The Surviving Engineering Division was formally established in Civil Engineering on July 1, 1979 with Dr. E.J. Krakowsky appointed as its inaugural chairman. The members of the Surviving Engineering Division were installed in the Fall of 1979 with some 12 students 8 of whom became the first graduates of the Division at the 1981 Spring Convocation.
- The Department of Chemical Engineering was renamed the



Mr. Howard Lowe, Billings, Montana, presents a check to the University for \$40,000.



ribbon cutting the new building.



Dr. E.J. Krakowsky, Chairman of the Surviving Engineering Division, presents a key to the new building.



Dr. E.J. Krakowsky, Chairman of the Surviving Engineering Division, presents a key to the new building.

strong floor

Department of Chemical and Petroleum Engineering in the Spring of 1980. That Department also prepared and had approved institutionally a proposal for a BSc programme in Petroleum Engineering which awaits funding approval from DAE.

- A Chair in Petroleum Engineering was proposed in 1980-81 and the associated fund raising, approved by the Board on September 17, 1981, was successfully concluded by April 1982. Total donations exceeded \$800,000, matched by the Government. The success of the campaign and the establishment of the Chair was largely due to the efforts of Dr. Fred L.



Photo 80 - South facade of the New Civil Engineering Wing (Block 98) 1983



Photo 81 - Staff in the Dean's Office - 1983/84 - (From left) Dr. Geoffrey, Susan May, Anne Widdell, John A. Macdonald, and John L. Taylor

Telford and Gordon Moore of Chemical Engineering, and Messrs. Keith McWalter, Chairman of the Fundraising Committee and President of Gulf Canada Resources Inc. and Bob Porteous of Haliburton Services Ltd. and member of the Petroleum Society of C.M.

- A Computer Engineering Minor in Electrical Engineering was introduced in the Fall of 1981, the first graduates from which received their degrees at the 1983 Spring Convocation. A proposal for a BSc in Computer Engineering was prepared in 1982, was institutionally approved and is awaiting funding approval by the Department of Advanced Education (DAE).
- A Letter of Intent for a BSc in Computer Integrated Manufacturing (CIM) was prepared by

Mechanical Engineering submitted to and approved by EFC in March 1983. The outgrowth of this proposal was the establishment of a CIM specialization in 1989 with its first graduates in the Spring of 1990. A Division of Manufacturing Engineering was established in Mechanical Engineering in 1990, with Dr. D.H. Norrie appointed as its first Chairman.

- The Dean prepared a long-term academic and space planning document for the Faculty in which undergraduate enrolment was projected to expand to 2,000 by 1990, a proposal which was submitted to the Vice President (Academic) and was approved by GFC in the Spring of 1982.
- The planning for a course-work only MEng specialization in Project Management in Civil Engineering

was initiated in the Spring of 1982, was subsequently approved and was implemented in the Fall of 1986 with Dr. H.A.R. de Paiva as Director, a position he held until June 30, 1991. Mr. Francis Hartman became his successor.

- During the Spring of 1984, repair work on the air conditioning ducts resulted in asbestos fiber dispersion in the C and D Blocks, referred to as the Asbestos Fiber Crisis. It forced shut-down of the C and D Blocks for 7 and 5 weeks respectively.
- Dr. Michael A. Ward was appointed V.P. (Research) effective July 1, 1984, after he had served as Head of the Department of Civil Engineering for 12 years. Except for a short period of absence due to health problems, he served in that capacity until June 30, 1992.



Photo 82 - Asbestos Fiber Crisis - 1984/85 - (From left) Dr. H.A.R. de Paiva and Dr. Francis Hartman





Plate-Q. The Engineering Courtyard with some of the young visitors, July 1931.

OUR PLACE OF INGENUITY

On July 1, 1985 Dr. L.T. Bruton returned to the Faculty as Dean after serving as founding Dean of Engineering at the University of Victoria for 2 years. He first came to Calgary in 1970 as Assistant Professor in Electrical Engineering, with degrees from London (England), Carleton (Ottawa) and Newcastle. After being promoted to the rank of Full Professor in 1976 he was appointed Head of the Department of Electrical Engineering on July 1, 1977, a position he held until July 1981 when he resigned for family reasons.

Soon after his return, Len Bruton selected Dr. N.G. (Nigel) V.P. Craig as Associate Dean (Student Affairs) effective September 1, 1985. He succeeded Eric Johnson who had held that position for 10 years. Dr. O.P. Om Malik, who had been on a year's sabbatical leave, was reappointed for a further 5 year term. Dr. M.A. (Michele) Sargious was Acting Associate Dean (Academic) during Om Malik's absence.

The Fall session started with a record undergraduate enrolment of 1,421 students and 149 full time graduate students (see Fig. 2.7). There were 84 full time academics and 92 support staff in Engineering. Space and resources were still as tight as when he had left two years earlier. In view of the record enrol-

ment and as incoming Dean he was able to negotiate a one-time special allocation to the Engineering operating budget which was approximately equal to the cut which had been suffered on the Faculty earlier in the year. The Vice President (Academic), Dr. Peter Craig, who had been in office only since July 1, 1985, was very sympathetic to the needs of Engineering, as the writer personally observed during the V.P.'s visit at a Dean's Advisory Council meeting in August of 1985. Shortly after that meeting, the V.P. was involved in a fatal accident in the mountains on the Labour Day weekend, a tragedy which shocked the entire University community.

During his first year as Dean, Len Bruton saw the programme proposals for a BSc in Computer Engineering receive final institutional approval and sent to the provincial government for funding approval, where it joined the proposals for a BSc in Petroleum Engineering and for extension of the graduate programme in Surveying Engineering. A Biomedical Engineering Group was formed during that year including staff members from all Engineering departments. Research activity in the Faculty was increasing despite the shortage in space with external research funding reaching the \$3.98



Fig. 2.6 Dr. L.T. Bruton and Dr. Peter Craig

million mark. At the Spring Convocation a new record was established by having 253 undergraduates receive their BSc degrees in Engineering.

Undergraduate student numbers decreased slightly in the Fall of 1986 while graduate student enrolment increased (see Fig. 2.7). At the December 4, 1986 EFC meeting the Dean officially welcomed Surveying Engineering as the fifth department of the Faculty with Dr. E.J. Krakowsky its first Head. The MEng Project Management Specialization in Civil Engineering, which had been introduced at the January 1986 EFC Council meeting, was implemented in the Fall of 1986 with 50 students. This programme, which is continuing, is a joint undertaking between the Department of Civil Engineering and the Faculty of Management. Research highlights of the 1986-87 academic year include the establishment of formal research links with researchers in China relating to the digital control of power systems, a contact which was achieved due to the efforts of Drs. Gordon Hope and Om Malik. A second important highlight was the so-called *Nepal Project* in which the Faculty, through the University's International Development Centre, became engaged in planning a major expansion of the Faculty of Engineering at Tribhuvan University in Katmandu, Nepal. Dr. Peter Vermeulen (ME) participated in this preliminary study and was given special leave by the University. During 1986-87 the academic staff in the Faculty was successful in obtaining total external research funding in

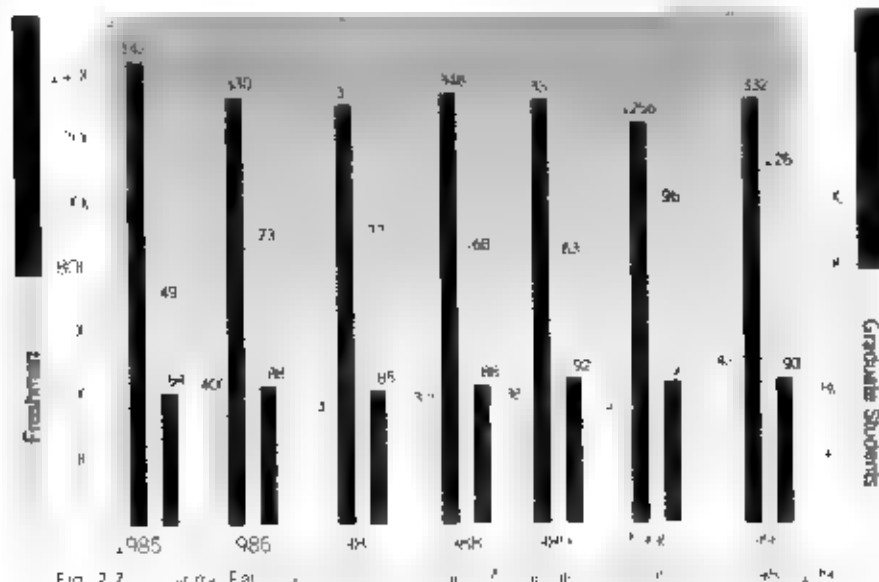


Fig. 2.7 Undergrad. Enrol.

Striving for Excellence 1985-1991

excess of \$5 million, a record level of support for the Faculty at that time.

Highlights of the 1987-88 academic year include a proposal by the Dean to introduce an International MENG Co-op Programme to allow foreign students to obtain their degrees as well as gain industrial experience in Canada. Canadian graduate students would go abroad to gain work experience outside of North America. By May 1988 it appeared that this programme could be initiated in the Fall of that year since funding was allegedly forthcoming from the Canadian International Development Agency, CIDA. As it turned out, the programme was implemented only in the Fall of 1989. At the December 1987 EFC meeting Len Bruton announced the appointment of Dr. S. C. (Chan) Wirasinghe as the inaugural Associate Dean (Research), a position which the Dean had first mentioned at the May 1987 council meeting. A proposal for a 5 year double-major BSc/BA programme to be offered jointly by the Faculties of Engineering and Humanities, was announced by the Dean at the February 1988 meeting of EFC. This new double-major BSc/BA programme was implemented that fall with 10 students enrolled. The programme turned out to be relatively demanding



Plate 2.84 This \$50,000 artwork replaced the Engineering Courtyard Fountain in 1985

so that by May 1989 four students had withdrawn. The Fall of 1989 saw the first students in the Computer Integrated Manufacturing (CIM) minor in Mechanical Engineering, students who graduated in the Spring of 1990.

The fund-raising campaign, which had been discussed and approved earlier in EFC, was given final approval by the Board of Governors in May of 1988 whereby funds were to be obtained for expansion of D-Block, for the establishment of an Engineering Energy Library and for the

expansion of the Project Management Specialization in Civil Engineering. On July 1, 1988 Dr. N. G. Shrivewent on a 6 month sabbatical leave. Orn Malik took on the extra responsibilities of Associate Dean (Student Affairs) for half a year.

In September 1988, Council delegated its powers in respect of student evaluation and approval of the graduation list to its Promotions and Awards Committee. At the same Council meeting proposals from all five departments for an undergraduate co-op programme were approved and were sent to the Academic Review Committee of the University for subsequent approval by GFC and implementation provided funding would become available.

On January 1, 1989 Dr. S. C. Wirasinghe went on a six month sabbatical leave during which Dr. A. Badakhshan (ChE) was Acting Associate Dean (Research). It was during the Spring of 1989 that the Dean decided to transfer the Faculty's numerically controlled (CNC) Matsuura machining centre to Mechanical Engineering, a decision which he announced at the May 1989 EFC meeting. At the same time, two technical staff members from Faculty Services including Mr. J. B. Wilkinson, who had been supervisor of the Faculty Workshop since 1966, as well as one



Plate 2.85 The staff in Student Affairs, L to R: Pam MacGregor, Lorraine McMurter, Pamela Parr, and Nancy Zentgraf, winter 1989

other technical staff member were transferred to Mechanical Engineering in return for a machinist from that Department joining the Faculty Workshop. This transfer of equipment, together with reallocation of resources from within the Faculty to Mechanical Engineering enabled that Department to consider introduction of a BSc programme in Manufacturing Engineering. At the November meeting of Council, Mechanical Engineering introduced such a proposal which was discussed, revised and approved at the June 1, 1990 meeting. An amended version of the proposed Manufacturing Engineering programme was resubmitted to EFC in February of 1991, approved and transmitted to GFC for approval and transfer to the Department of Advanced Education. At



S.C. Wirasinghe

Plate 8 Further senior faculty advisors (1987-89)



R.L. Day

the same November 1989 EFC meeting, a Biomedical Engineering programme was also proposed, discussed and approved.

In relation to computers and computer-aided equipment it is significant to note that Len Bruton established a Faculty Advisory Committee on Computing and through that Committee a faculty-wide cooperative procedure for the acquisition of computer equipment. This procedure and policy led to major computer acquisitions in all departments of the Faculty resulting in modernization of the undergraduate computer laboratories at a total cost of several million dollars (see Chapters II-V).

Len Bruton announced his intention not to let his name stand for a second term late in 1989. By early Spring the new Dean, Dr E. Ted Rhodes, had been selected and his appointment was announced. Ted Rhodes was welcomed to the March 20, 1990 EFC meeting at which a proposal to

change the name of the Electrical Engineering Department to the *Department of Electrical and Computer Engineering* was also approved.

Edward Rhodes took office on July 1, 1990. He came to the Faculty from industry where he served in a senior administrative position for the period 1987-1989. Prior to that he had been at the University of Waterloo since 1964, serving as Chairman of the Department of Chemical Engineering for the last 11 years of his tenure at that institution (1976-1987).

At his second EFC meeting Ted Rhodes announced a change in the Faculty administrative structure. Effective January 1, 1991, the position of Associate Dean (Student Affairs) was changed to Associate Dean (Undergraduate Studies) with Dr R.L. Day continuing in the position. The position of Associate Dean (Academic) was eliminated effective December 31, 1990 after Om Malik had agreed to serve an additional six months after the expiry of his second five-year term in July 1990. The position of Associate Dean (Research) was retained with Dr S.C. Wirasinghe continuing in that position. A new position, that of Communications Manager of the Faculty of Engineering, was created and Mrs. Kathleen Rempel appointed to the post effective April 1991. Dr M.F. (Matt) Mohlad succeeded her in October 1991.

At the February 1991 EFC meeting Dean Rhodes introduced a proposal for restructuring the Faculty Committee structure, a proposal which

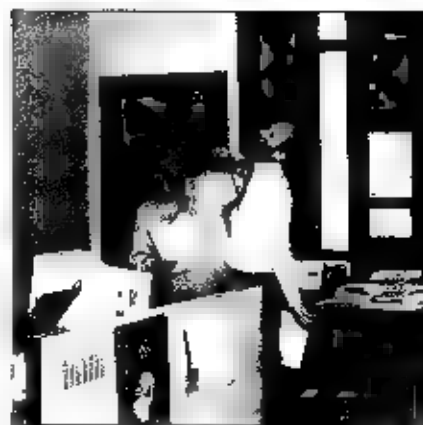


Plate 18 The patiently friendly persuasion method: the Dean's office for keeping Associate Dean R.L. Day (left) and Ted Rhodes in the Faculty meeting at 1140 George Street, Winter Term, 1988

was approved by Council. It was at the same meeting that the Dean indicated that he expected a major announcement some time very soon with respect to substantial additional space becoming available for Engineering. Soon after the meeting an announcement from the President's office indicated that an agreement had been reached between The University of Calgary and Petro Canada for leasing the Petro Canada Building effective July 1, 1991, for a 10-year period at a nominal sum per year. After the announcement and the assignment of the building to the Faculty of Engineering, Dean Rhodes in turn allocated the entire building to the Department of Mechanical Engineering thus providing a new home for that Department effective July 1, 1991.

During the Spring of 1991 the new



Plate 28 Some of the Engineering Faculty Services staff in R. A. Poirion, Paul Layton, Charles J. H. Mead, Fairhead, Brian Wilson, John van Bentham, Ben J. Jansz, George H. J. 28-88

EPILOGUE

We have come to the end of the first portion of our *time travel*, which was a *whirlwind tour* of the Faculty's highlights. Travel as we did along the *high road*, we gained only glimpses of some of the interesting sights along the five *departmental side roads* which we will visit in subsequent chapters. However, before embarking on our next trip, let us pause for a moment to take stock of what we have seen and reflect on the highlights. We might even reminisce a bit.

As our little trip indicated, we have much to be proud of and thankful for. We are proud of our graduates who, after receiving their degrees, have established their careers and many of them have become leaders in their environment, in the profession and in society. We started with 59 eager first year Engineering students at the SA T Campus in September 1957 with only two engineering professors guiding their first strides along a career path. Those modest beginnings changed suddenly when in the Fall of 1960 the whole Calgary Operation of the University of Alberta moved to a new campus along the Old Banff Highway. With new and more spacious quarters the Engineering programme offerings were expanded to include the second year of the curriculum which meant more students (see Fig. 2.8). Three young academics were transferred from Edmonton to Calgary to help with the increased teaching load.

The year 1963 brought dramatic

changes to Engineering at Calgary. The administration changed with the establishment of a Division of Engineering and the appointment of Dr. A.M. Neville as its Chairman. More significant however was the change in academic environment which Adam Neville's arrival instigated. Suddenly, the *farm-team-junior college* atmosphere was transformed into an Engineering Faculty operation including graduate students, graduate course offerings and an emphasis on research in addition to undergraduate instruction.

Adam Neville's arrival also signalled the start of a period of unparalleled growth in Engineering at the new campus. His appearance on the scene fortunately coincided with the move of Dr. G.W. Govier to Calgary after he had resigned the Deanship of the Faculty at the U of A and decided to work full-time as chairman of the Alberta Oil and Gas Conservation Board. He was interested in continuing to be involved in the building of Engineering at Calgary and was appointed Professor of Engineering (part time). These two senior academics became the initiators and planners of and the driving force for the establishment of the Faculty of Engineering and the creation of an Engineering Center at this campus. They managed to have all this achieved within a short 5 year period from 1963-68. The first Engineering Building, the E-Block, was completed in late Summer of 1964. Faculty status was obtained on April 1, 1965 with A.M. Neville appointed as first Dean

of the Faculty. The rest of the Engineering Center was built in stages completing the D-Block, the E-Lecture Theatre Wing and the C-Block in 1966, the B-Block and Energy Transfer Laboratory in 1967 and the A-Block in 1968.

The first year of the new Engineering curriculum was implemented in the Fall of 1965 with subsequent years phased in consecutively until the fourth year was introduced in the Fall of 1968 leading to the first BSc graduates from our Faculty in the Spring of 1969. That first graduating class size of 85 students has swollen to over 250 due to the introduction of new programmes in Surveying Engineering, Computer Engineering and Manufacturing Engineering during the period 1979-1989. In 1987 we saw 284 of our undergraduates and 65 graduate students receive their degrees (see Fig. 2.9).

After those years of explosive growth, there came the period of consolidation and stabilization during which we concentrated on building a name for this Faculty. We published papers in international journals, organized national and international conferences and travelled to far away places to present the results of our research and to help make this Faculty better known in the four corners of the world. Maintaining standards and quality during the tough times which followed was difficult. Student numbers kept on increasing without corresponding growth in physical facilities, equipment or staff. To maintain quality in our undergraduate programme, enrollment quotas were introduced for first and second year and subsequently also for entrance into the Departments. External research funding became even more important during those lean years. It also became more difficult to obtain which demanded improved performance and increased initiative and ingenuity. And yet, the quality of research helped our academics to obtain annual external funding in excess of \$5.0 million starting in 1986-87 (see Fig. 2.9) and to establish this Faculty as an internationally recognized School of Engineering and Centre of Engineering Research, attracting staff, students and visitors from around the globe and winning national and international prizes and awards on an ongoing basis.

During the period reviewed here, we saw the economy go through a number of full

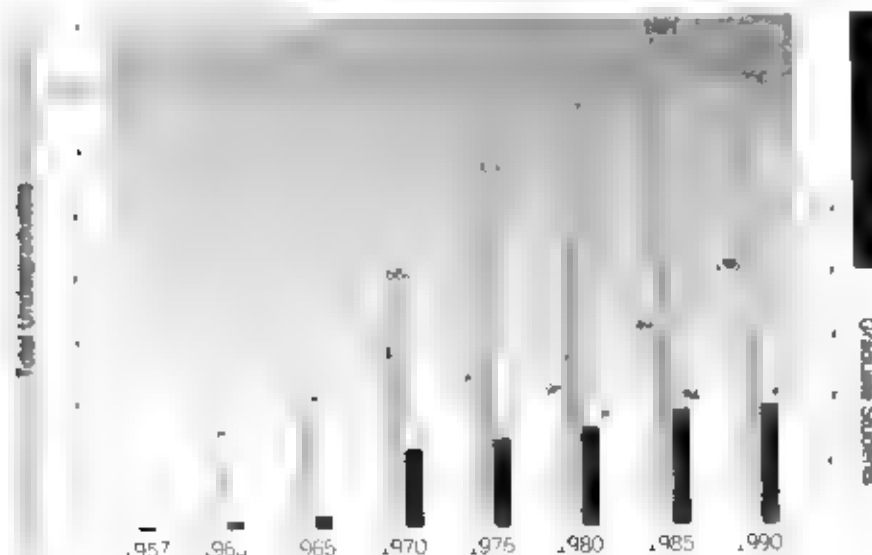


Fig. 2.8 Undergraduate and Graduate Student Enrollment and Academic Staff Statistics 1957-1990

Summary and Reflections

cycles, swinging from one extreme to the other from conditions of boom to recession. Through it all, the Faculty continued to develop and grow, seemingly operating on an *even keel* and making contributions to the profession and society at large. Throughout those 34 years we were fortunate to have had a hand in educating the engineers of the future, to have been able to carry out research aimed at solving problems relevant for society and to the environment, thereby shaping and influencing the future itself.

Our narrative was necessarily brief and restricted to factual information, interspersed only sparingly with humorous or anecdotal material. The many stories associated with the hard work, the care and dedication which hundreds of individuals, both staff and students, contributed to the building process of our Engineering community was left untold. This might be the time, however, to reminisce briefly and recall some of those stories and aspects of the *good old days* and those *years of the firsts*.

There were those first 8 years of Engineering at Calgary during which we were part of the Faculty at the U of A. Our Dean and Department Heads were in Edmonton. Final examinations and mid-term tests were consolidated exercises for the students on both campuses which meant Calgary instructors having to travel to Edmonton to mark examinations. Departmental and faculty council meetings were in Edmonton requiring additional trips to the northern city. Gaining faculty status in 1965 was a welcome change in addition to providing the much desired and hard fought for independence.

We were a small Engineering operation during those first 8 years with few students and even fewer staff. Those were the years of intimate friendship in the Faculty without departmental boundaries. Staff and students consisted of small groups so that one could get to know everyone. They were also the times when provincial coffers were much healthier than in subsequent years when budget cuts were an unknown phenomenon and when annual financial planning was initiated within the units, building the budget from the *bottom up* instead of from the *top down*, as is done today. Parking was free and what more Professor Walter Stlweil insured that every staff member's reserved stall was marked by a personalized name plate. Not until 1967 was the *free parking* privilege at The U of C revoked with the introduction of an annual parking fee of \$1.

Then came the years of explosive growth with the excitement and rewards associated with being involved in the building process. There were new colleagues joining the Engineering team every year or even several times a year which added to and helped to create a climate of dynamism, vitality, optimism and happiness. This atmosphere was reinforced by the fact that almost all of the staff were young men and women at the start of their professional career.

Within such an atmosphere and with so many young people it was natural to have Christmas parties, sports days and many other social events for staff and mixed events for staff and students which were always successful due to the modest size of the groups and the exuberance of youth. Those were the years of student

staff mixers with hilarious entertainment and *boat races*, student staff soccer matches, outings into the Rockies, skiing in the winter and hiking and climbing in the summer, barbecues, parties and celebrations.

Of course it was not all fun. There were few staff so that the administrative and committee work load per individual was heavier than in later years. There was also more work in connection with our teaching, a most every course was new for which course notes had to be prepared and built up. Due to our small number, we often had to teach several undergraduate and graduate courses per term. The initiation of our research also took extra time which occupied evening hours and weekends. And yet we found time to enjoy ourselves. The work itself brought much satisfaction, rewards and enjoyment, like a friendly smile or *thank-you* after a session with a student who was looking for help or seeing our young men and women walk across the convocation stage exuding happiness and bursting with pride, or being recognized for contributions to research, technology transfer, the profession or society at large.

We have seen from this first portion of our brief trip through the history of our Faculty that we have reached many of our goals. We have grown into a many faceted, many talented organism with outstanding people continuing to make significant contributions in their area of expertise which are recognized by prestigious awards like the Ernest C. Manning Award and the Kilian Prize, won by two of our colleagues during 1991. We continue to attract top quality students who win provincial, national and international awards and medals, such as the FIG prize, the Athlone Fellowship and the APEGGA Gold Medals won by our students during the past academic year. We are proud of what we have grown into during these past 34 years. We are thankful for the magnificent physical facilities which, although presently overcrowded, are some of the best in the country. But most of all, we are grateful for the continuing support from the profession, the community and the people of this province.

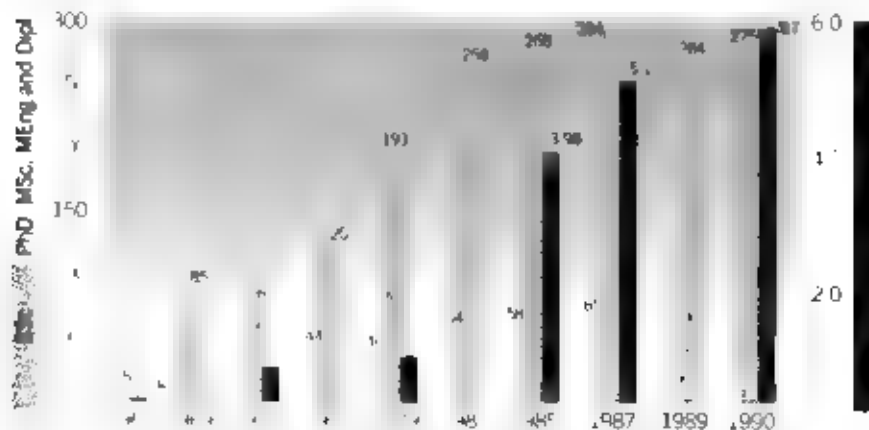


Fig. 2.9 Convocation Statistics and Annual External Research Funding in Engineering, 1965-1990

FACULTY OF ENGINEERING

h STUDENT AFFAIRS

Associate Dean (Student Affairs): Dr. Day, R. L.
Associate Dean: Dr. Day, R. L.
(Undergraduate Studies) (since 91.01.01)
Secretary: Ms. McMaster, Lorraine
Admin. Asst.: Mrs. Parr, Pamela
Secretarial Staff: Mrs. Zendran, Nancy
Ms. MacGregor, Patricia

c. ENGINEERING READING ROOM/LIBRARY
Mrs. Raisbeck, Patricia E
Ms. McCallen, Evelyn

c. ENGINEERING READING ROOM/LIBRARY

- () Stores
 - Mr. Lareshen, Gregory
 - Mrs. Patchett, Heather
 - Mr. Pointon, Al
- () Drafting and Photography
 - Technical Supervisor: Mr. Unterberger, Bert
 - Mrs. Kiddle, Anne

Table 2.2 ACADEMIC SECRETARIES TO EFC — 1974-91

During Dean Bob Ritter's last year of tenure Engineering Faculty Council established an Ad-hoc Committee to study the rules of order for conducting EFC business. The Committee was chaired by Dr. P.J. Vermeulen. At the March 1974 meeting of Council, the Committee reported and made certain recommendations which were approved with amendments. The main recommendations included:

- Establishing the position of Academic Secretary of EFC with the responsibility for the minutes of meetings of Council and ensuring that they are a true record of the business transacted with related discussion
- Appointing an Academic Secretary as soon as possible
- Adopting Robert's rules of order for the conduct of Council's business.
- Introducing a Dean's Report, a Secretary's Report and a Question Period as regular agenda items for Council's meetings

Adoption of these and other recommendations of the Committee helped to streamline the conduct of business of EFC. The following academic staff members have served in the capacity of Academic Secretary for EFC:

1974-75	Dr Heidemann, R A. (ChE)	1983-84	Dr Rao N D (EE)
1975-76	Dr Vermeulen, P J. (ME)	1984-85	Dr Vinogradov, O. (ME)
1976-77	Dr McDuffie N G (ChE)	1985-86	Dr Vinogradov, O (ME,
1977-78	Dr Malik O P (EE)	1986-87	Dr de Paiva, H A R (CE)
1978-79	Dr Malik, O P (EE)	1987-88	Dr de Paiva, H A R (CE)
1979-80	Dr Gillott, J E (CE,	1988-89	Dr McMullen, A E. (CE)
1980-81	Dr Gillott, J E (CE)	1989-90	Dr Sigmund, T M (ChE)
1981-82	Dr Rowe R D (ChE)	1990-91	Dr Sigmund, T M (ChE)
1982-83	Dr Rao, N D (EE)	1991-92	Dr McMullen, A E. (CE)

Table 2.3 TIME LINE OF ADMINISTRATION - 1957-1991

		FACULTY OF ENGINEERING				
Part of Faculty at U of A	Year	Administrator/Dean	Dean's Secretary	Assistant Dean/ Assoc. Dean (Student Affairs)* & Adm. Assist ^b	Head Common Curriculum/Assoc. Dean (Academic)†	Assoc. Dean (Research)
Autonomous Faculty	1957	H.R. McArthur, Administrator (R.M. Hardy, Dean)				
	1958	H.R. McArthur, Administrator (R.M. Hardy, Dean)	Maude Brier	—	—	
	1959	H.R. McArthur, Administrator (G.W. Govier, Dean)	Maude Brier			
	1960	H.R. McArthur, Secretary to Faculty (G.W. Govier, Dean)	Maude Brier	—		
	1963	A.M. Neville Chairman of Division (R.M. Hardy, Dean)	Kathleen Dunkley Mary Christopherson (1.0.08-)			
	1965	A.M. Neville (04.01)	Mary Christopherson	H.A.R. de Paiva (11.01) Elma Scott (Krbavac) (65.05.17-)		
	1967	H.A.R. de Paiva Acting (07.01-)	Mary Christopherson	J.E.S. Venart Elma Scott (Krbavac)		
	1968	R.A. Ritter (07.15-)	Maureen Novak (01.01)	J.E.S. Venart Elma Scott (Krbavac)	D.G. Huber (08.01-)	
	1970	R.A. Ritter	Bonnie Norsten (06.15-)	A.E. McMullen Elma Scott (Krbavac)	D.G. Huber	
	1971	R.A. Ritter	Pat Cripps (03.22-)	A.E. McMullen Elma Scott (Krbavac)	D.G. Huber	
	1972	R.A. Ritter	Pat Cripps	A.E. McMullen Gerry Dyer ^a (06.02-)	A.A. Torvi Acting (07.01-)	
	1973	R.A. Ritter	Pat Cripps	A.A. Torvi Gerry Dyer ^a	D.G. Huber (07.01)	
	1974	D.G. Huber Acting (08.01-12.20)	Eva Boyd (10.01-)	A.A. Torvi Gerry Dyer ^a	A.E. McMullen Acting (08.01-)	
	1975	A.E. McMullen Acting (01.01-06.30)	Eva Boyd	A.A. Torvi Gerry Dyer ^a	R.A. Stein Acting (01.01-)	
		T.H. Barton (07.01)	Donna Geeke (1.1.26-)	E.W. Johnson ^a (07.01-) Gerry Dyer ^a	R.A. Stein (07.01-)	
	1977	T.H. Barton	Marjorie May (09.01-)	E.W. Johnson ^a Pamala Parr ^a 10.03-	R.A. Stein	
	1979	T.H. Barton	Marjorie May	E.W. Johnson ^a Pamala Parr ^a	O.P. Malik (07.01-)	
	1980	T.H. Barton	Frances Austin (01.28-) Jill Andrews (04.07-11.30)	E.W. Johnson ^a Pamala Parr ^a	O.P. Malik	
	1981	O.P. Malik Acting (01.01-) T.H. Barton (07.01-)	Marjorie Fauvel (Holland) (06.08-)	E.W. Johnson ^a Pamala Parr ^a	O.P. Malik	
	1984	T.H. Barton	Marjorie Fauvel (Holland)	E.W. Johnson ^a Pamala Parr ^a	M.A. Sangious Acting (07.01-)	
	1985	L.T. Bruton (07.01-)	Marjorie Fauvel (Holland)	N.G. Shrive ^a (09.01-) Pamala Parr ^a	O.P. Malik (07.01-)	
	1987	L.T. Bruton	Edie Schulz (02.01-)	N.G. Shrive ^a Pamala Parr ^a	O.P. Malik	
	1988	L.T. Bruton	Edie Schulz	N.G. Shrive ^a Pamala Parr ^a	O.P. Malik	S.C. Wirasinghe (01.01)
	1989	L.T. Bruton	Edie Schulz	R.L. Day ^a (07.01-) Pamala Parr ^a	O.P. Malik	A. Badakhshan Acting (01.01-)
	1990	E. Rhodes (07.01-)	Edie Schulz	R.L. Day ^a Pamala Parr ^a	O.P. Malik	S.C. Wirasinghe
	1991	E. Rhodes	Edie Schulz	R.L. Day ^a Pamala Parr ^a	††	S.C. Wirasinghe

*The Assistant Dean's position, instituted on 65.11.01, was changed to Associate Dean (Student Affairs) effective 75.09.01.

**The position of Associate Dean (Student Affairs) became Associate Dean (Undergraduate Studies) 91.01.01.

†The responsibilities of the Head of Common Curriculum were incorporated into the position of Associate Dean (Academic) as of 75.09.01.

††The position of Associate Dean (Academic) was eliminated 90.12.31; a position of Faculty Communications Manager was created 91.01.01.

NOTE: Administrative Assistants to the Dean: H.A.R. de Paiva (65.04.01-65.10.31); Donna Geeke (70.04.01-present).

Table 2.4 LIST OF SUPPORT STAFF — 1957-91
FACULTY OF ENGINEERING

DEAN'S OFFICE AND COMMON CORE

Research and Technical			
Ambury, K.	1969-1972	Krausas, A.	1967-1972
Cameron, A.	1988-1991	Kult, L.	1964-1967
Dittrich, M.	1984-1987	Lenderbeck, C.	1985-1988
Fogarasi, M.	1964-1970	Low, A.	1968-1973
Jackson, C.	1969-1974	Marbunuk, E.	1964-1967
Jamison, J.	1969-1973	McRae, J.	1968-1990
Nemeth, J.	1965-1967		
Pat, G.	1985-present*		
Porter, S.M.J.	1964-1966		
Turnball, D.	1969-1974		
Vall, M.	1967-1984		
Wilding, J.	1966-1972		
Administrative and Secretarial			
Bartlett, K. (Pellow)	1987-1990	Fewtrell, F.	1977-1979
Beatty, E.	1974-1975	Geekie, D.	1970-present
Boyd, E.	1964-1980	Gruher, K.	1966-1969
Brier, M.	1958-1962	Hawrelak, L.	1961-1964
Carnie, J.	1977-1994	Jaggard, A.	1983-present
Christopherson, M.	1963-1967	Kersey, S.	1991-present
Cooper, K.	1968-1969	Magee, B.	1971-1974
Cripps, P.	1971-1974	May, M.	1962-1964, 1974-1980
Dyer, Gerry	1969-1972	May, S.	1982-1985
Fauvel, M. (Holland)	1981-1987	McCully, K.	1972-1974
McElroy, D.	1973-1974		
Nakamura, M.	1975-1977		
Noreen, B.	1970-1971		
Novak, M.	1965-1970		
Rae, J.	1982-1983		
Rempel, K.	1991		
Robertson, C.	1982-1983		
Schulz, E.	1986-1993		
Wagner, D.	1966-1967		
Wilson, N.	1980-1981		

STUDENT AFFAIRS

Cote, M.	1975-1977	McMaster, L.	1982-present	Whitelaw, R.	1974-1977
Dyer, G.	1972-1977	Nielson, D.	1977-1980	Zendran, N.	1980-present
Krbavac, E.	1965-1972	Parr, P.	1977-1994		
MacGregor, P.	1984-present	Wedel, M.	1972-1974		

ENGINEERING READING ROOM/LIBRARY

Benko, G.	1969-1972	McCallen, E.	1990-present	Raisbeck, P.	1975-present
Marsden, M.	1972-1975	Raby, H.	1979-1989		

FACULTY SERVICES

Machine Shop			
Cornack, J.	1967-1988	Immer, C.	1980-present
Daley, B.S.	1982-1989	Lavoie, P.	1984-present
Eastwood, W.	1966-1968	Muchel, H.	1968-1980
Eremko, B.	1967-1982	Nicola, F.	1968-1977
Gallacchi, E.	1980-1983	Sandmaier, N.	1968-1984
Scorey, R.	1989-present		
Somers, S.	1978-1980		
Van Benthem, J.	1967-1994		
Wilkinson, B.	1966-1989		
Stores			
Birchenall, F.	1967-1970	Laureshen, G.	1989-present
deWeerd, P.	1968-1979	McCann, J.	1978-1981
Erturt, A.	1969-1980	Patchett, H.	1984-present
Higgins, J.	1969-1984	Ponton, A.	1981-1994
Toews, J.	1980-1988		
Ulmer, v.	1967-1972		
Unwin, L.	1971-1976		
Woodhatch, J.	1967-1969		
Drafting			
Balliey, J.	1978-1980	Kenyon, H.	1974-1977
Bishop, K.	1982-1987	Kiddle, A.	1987-present
Brink, D.	1977-1980	Lenz, B.	1967-1968
Chute, A.	1980-1982	MacLean, M.	1971-1974
Jaquish, E.	1968-1969	McCarthy, A.	1970-1971
Nyberg, T.	1970-1971		
Unterberger, B.	1965-present		
Zarowny, D.	1980-1989		

* Present refers to the time of writing, 1991-1994



a President H.S. Armstrong is welcoming the guests. students and staff. L to R. Identified Person H.E. Palmer C.C. McLaurin E.S. Venart A. Thorsser R. Pilkington W.G. MacEwan

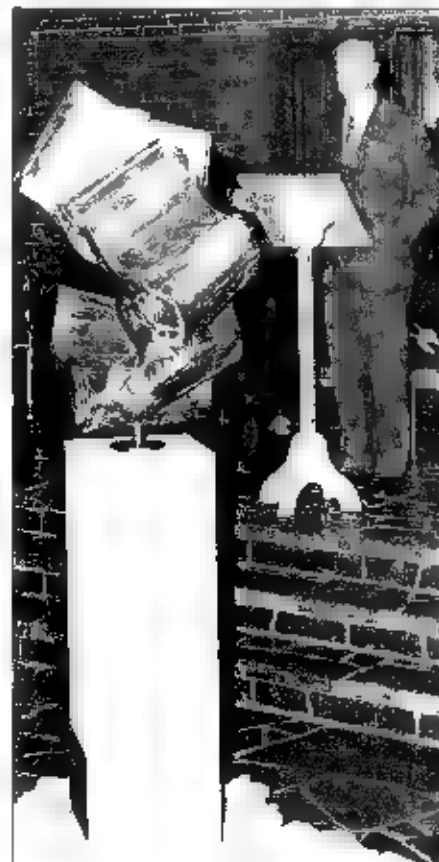


c Mrs. Palmer and President Armstrong in the process of unveiling the sculpture



b Chancellor C.C. McLaurin addressing the assembly

Plate 2.9 The unveiling of a sculpture designed by Calgary artists had the served as an official opening of the Engineering complex with the Electrical Engineering wing nearing completion. The ceremonies were held in the Central Foyer of the Engineering complex under the chairmanship of Assistant Dean Dr. E.S. Venart. The sculpture which was presented to the Faculty by the Engineering Institute of Canada Wives Club of Calgary was unveiled by the Club's past president, Mrs. M.E. Palmer with the assistance of the President of the Club, Dr. H.S. Armstrong. Other members of the official party included Mrs. R. Pilkington, the president of the Club, the Hon. W.G. MacEwan, Lieutenant Governor of Alberta, Chief Justice C.C. McLaurin, the Hon. S.H. Chancellor and Mr. A. Thorsser, Chairman of the Board of Governors. Monday May 11, 1968 see also Plate 2.6.



d The Hon. Grant MacEwan bringing greetings from the Province



Plate E — Stairway in the Central Foyer of the Engineering Complex; C-Wing - ca. 1967.

A Place of
Ingenuity

III.

Department of
CHEMICAL
AND PETROLEUM
ENGINEERING

THE SILVER ANNIVERSARY

A very good start!

That is how the Department of Chemical and Petroleum Engineering's entry into the 1990's may be described. Let us briefly review some of the reasons for such a description.

The decade had barely begun when on March 19th the Board of Governors approved the appointment of Dr. Edward Rhodes as Prof. of Chemical Engineering and Dean of the Faculty effective May 1 and July 1, 1990, respectively. The day after, on March 20, the new Dean, a distinguished chemical engineering scholar, was welcomed at Engineering Faculty Council. Not since 1968 had a chemical engineer been selected for the deanship in Engineering, an event which surely was a positive influence on the Department.

This development also helped to reinforce the Department's growing optimism with regard to realization of its long-standing primary goal, the construction of the Chemical Engineering Extension, first proposed in 1967. There appeared to be good reasons for optimism. Two years earlier, in February 1988, a fund-raising drive for such an extension was approved by the Board as a top priority for the institution. The 25th anniversary *Building on the Vision* campaign was to be launched later in 1990 and promised to be a most successful undertaking. The prospect of having the extension included in this cam-

paign spelled confidence for Chemical Engineering and made its construction appear more likely in 1990 than at any other time during the preceding 2 decades. As a corollary, it was argued that a successful fund-raising campaign would not only provide a new build-

ing with the space required for programme expansion but would demonstrate, most graphically, industry's continuing strong support of the Department and its activities. These two factors, it was felt, might just be a sufficient and appropriate catalyst to trigger action in the Department of Advanced Education leading to the approval of the Petroleum Engineering Programme Proposal. Chemical Engineering's second major dream.

There were a number of additional events during 1990-91 which helped to enhance the Department's optimism and confidence with regard to the future and contributed to its *good start* into the last decade of this millennium. Firstly, a departmental all-time high enrolment of 143 undergraduates was attained in the Fall of 1990, including 84 and 58 full-time senior and junior students, respectively, and one 4th year



Anderson,
Cheryl Marie
1992



Batycky,
Richard Pank
1990



Forstner
Halvaine Lana
1991

Plate 3.1 The Chemical and Petroleum Engineering APEGGA Gold Medal winners 1990-92

part-time registrant (see Fig. 3.1). The 4th year class size established a new departmental maximum leading to a record crop of BSc graduates in 1991, numbering 69 as compared with the 55 degree recipients in 1990 (see Fig. 3.2).

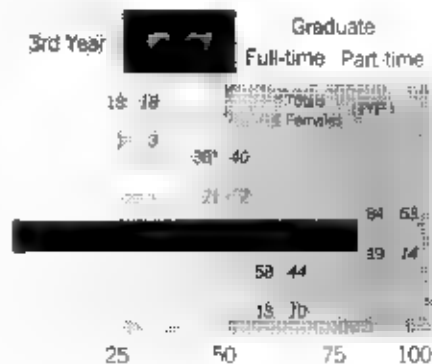


Fig. 3.1 Registration Statistics for Chemical and Petroleum Engineering, Fall 1990 (with 1991 figures in italics)

Secondly, the undergraduate female enrolment during 1990-91, numbering 32 and including 19 senior and 13 junior students, set new records for the Department both in terms of actual numbers and as a percentage of total enrolment or class size (see Fig. 3.1). The large 4th year female contingent resulted in 16 women graduates in 1991, a further new record for Chemical Engineering. These undergraduate female enrolment and convocation statistics also established new Faculty maxima thereby reinforcing the Department's traditional leading role in attracting the largest number of female students in Engineering.

The academic excellence of the



Plate 3.2 - The Chemical and Petroleum Engineering secretarial staff discussing word processing techniques with the Head, Dr. R.A. Heidemann. L to R: Mrs. N. Wilson, Ms. C. Homan, Ms. L. Jeffery, Mrs. L. Renaud, Mrs. Streets not present.

Chemical and Petroleum Engineering 1991

Chemical Engineering undergraduate student body and its involvement in extracurricular activities was an additional encouraging factor for the staff. The long list of scholarship and award winners for 1990 and 1991 underlines this high quality performance. The female student group had a particularly outstanding record during these 2 years as indicated by

BSc	PhD	MSc	MEng	Dipl
Totals				
Females				
				58/69
				11/16
4		4		60

Fig. 3.2 Convocation Statistics for Chemical and Petroleum Engineering 1990 with 1991 figures in parentheses

the fact that 8 of 19 and 7 of 16 award recipients for 1990 and 1991 respectively, were females. Also, 2 of the 3 APEGGA Gold Medal winners, for 1990-92 in Chemical Engineering were women (see Plate 3.1), namely Misses Hali Janine Lana Forstner and Cheryl Marie Anderson, the latter of whom also won the 1992 EIC Student of the Year Medal and the Society of Chemical Industry Merit Award. This prestigious industry award was won by Misses Severin and Dornan and Hukhar Hui for 1990 and 1991, respectively (see Plate 3.3). The gradu-

ately (see Plate 3.3). The 1990 APEGGA Gold Medal in Chemical Engineering was awarded to Richard Panko Balycky. Interestingly 3 of these 5 outstanding young students, the two female Gold Medal winners and Mr. Hui were awarded fellowships at the California Institute of Technology for their graduate work.

The Department's research activity was a further confidence builder. One indicator of this activity, external funding reached the \$2.3 million mark annually in 1990-91, a maximum for the Department and a record high for the Faculty to date. A second research indicator, the full-time graduate student enrolment also peaked during the period under review, numbering 38 and 40 students for the 1990-91 and 1991-92 academic years, respectively. The former group comprised 13 PhD, 24 MSc and 1 MEng candidates with 1 doctoral and 6 MSc female students. The Fall 1991 full-time male and female graduate enrolment varied from these figures only by one additional male student in each of the PhD and MSc groups. In addition, there were 18 part-time graduate students in each of the 2 academic years, 1 PhD, 3 MSc and 14 MEng candidates during 1990-91 and 1 PhD and 17 MEng registrants the following year. The MEng groups included 1 and 3 female students respectively (see Fig. 3.1). The gradu-



Hali Janine Lana Forstner, 1990



Cheryl Marie Anderson, 1991

Plate 3.3 The Society of Chemical Industry Merit Award winners

ate degree recipients for 1990 and 1991 are also indicated on Fig. 3.2 and included 2 PhD, 4 MSc and 5 MEng graduates for the former and 4 PhD, 4 MSc and 2 MEng students for the latter year. The female degree recipients in both years were MEng students.

The Department continued to have an active Diploma programme graduating one female student in each of 1990 and 1991 and also a male student in 1991 (see Fig. 3.2), thereby maintaining its front running position in Engineering by a wide margin for the total number of Diploma graduates.

The positive outlook prevailing in Chemical Engineering during 1990 was also enhanced by the quality of its graduate students many of whom were scholarship winners in the Faculty and in the Department prior to obtaining their BSc degree. For example, the 1988 APEGGA Gold Medal winner in Chemical and Petroleum Engineering and the recipient of numerous awards during her undergraduate studies, Miss Cecilia Wai-Kam Tse continued to win scholarships during her graduate studies, as many as three in one year (see Table 3.3). Other star performers, winning several scholarships annually during 1990-91, included Messrs. S.C. Gupta, A. Negiz and T.S. Pugsley, the latter also receiving the *best paper award*, a prize and certificate at the Annual National Student Conference of the Canadian Society for Chemical Engineering, CSCHE, held in Montreal, Feb. 2-5, 1992.

During the academic year 1990-91 the Department offered 19 Under-



Plate 3.4 Mr. Don Dornan, staff member in Chemical and Petroleum Engineering discussing a project with students. The project is to be undertaken with the Department's Building Machinist's shop with a fully 3-axis digital measurement system. A student, Mr. Dornan, is also a member of the B.T. Mies, J. M. Dornan and H. Mikalson M. N. Singh.

graduate and 18 graduate courses to its 143 undergraduate and 56 graduate students. In addition, these courses provided educational experience for a substantial percentage of the Faculty's 183 unclassified and visiting students. Also, some of the Department's senior courses are traditional favorites as options for students from other departments, particularly for the 4th year Mechanical Engineering group. These instructional activities and the teaching of common core courses involved 17 full-time academic staff, 8 sessional instructors, the full-time graduate students and the Department's secretarial and technical support staff (see Plates 3.2 and 3.4 and Table 3.1). In carrying out its research, the staff also relied on the assistance of 30 research associates/assistants, postdoctoral fellows, visiting professors and technologists (see Table 3.1). The administrative load associated with graduate students was taken over by Dr. A.K. Mehrotra upon his appointment as Associate Head, Graduate Studies effective November 1, 1990.

The appointment of Dr. E. Rhodes was the only academic staff addition during 1990-91. Dr. M.A. Hastaoglu went on leave effective Sept. 1, 1990 to the King Fahd University in Dhahran, Saudi Arabia. He was expected to return on Aug. 31, 1992 but, instead, resigned a few months prior to that date. An *orditimer*, Mr. John R. McRae, who had joined the Faculty in Sept. 1968 as computer programmer and analyst for the common core, retired on Dec. 31, 1990. He was transferred into the Department on Nov. 1, 1981. A loyal secretarial staff member, Mrs. Jean Streets left in May

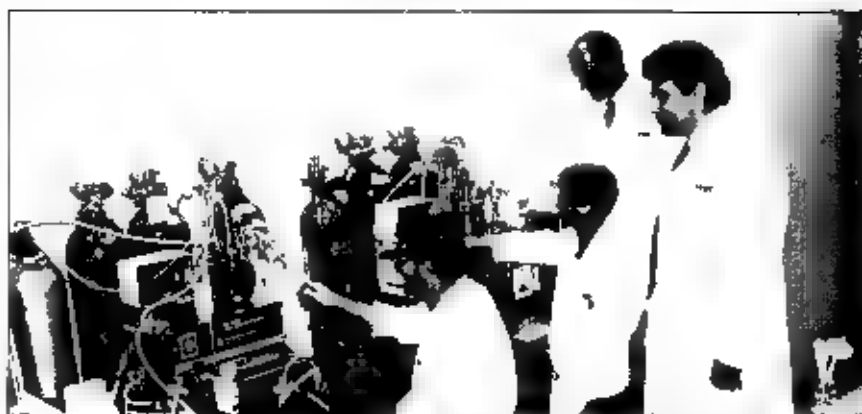


Plate 3.5 Members of the Pharmaceutical Production Research Facility (PPRF) are reviewing the operation of two different centrifuges. This apparatus is used to separate "hydrocarbons" and "hydrocarbons" used in the production of a vaccine (right). The research laboratory is housed in "Discovery Place" in the University Research Park at R.T. "Discovery Place" is a joint project of Professors L.A. DeWitt and N.E. Kalogerakis (see also Plate 3.9).

1991 due to back pains. To everyone's heartfelt sorrow, these pains developed into a serious illness to which she succumbed within a year.

One of the Department's many academic staff highlights during the period under review was the selection of Dr. R. Gordon Moore as recipient of the 1989-90 Students' Union Teaching Excellence Award. His contributions to industry and the profession were recognized by being elected member of the Board of Governors of the Petroleum Society of the Canadian Institute of Mining (PSCIM) and being named to the *Distinguished Member Roll* of that society. The same society also acknowledged Dr. Roger M. Butler's activities in industry and in the profession by bestowing upon him one of the inaugural fellowships in 1990. The highlight of the year for Prof. Butler was the *Esso Significant Innovation Award* presented in December, 1990 at the Esso Resources

Canada Ltd. Research Centre in the University Research Park. In recognition of his role in industry adoption of horizontal wells for accessing hydrocarbons. As if to underline the relevance and importance of his work in this area, at the 42nd Annual Technical Meeting of PSCIM, held in Banff, April 21-24, 1991, his paper on *Gravity Drainage to Horizontal Wells* was selected for the *best paper award*.

A main event for the Faculty and the Department was the *Engineering Excellence Award Ceremony* in the B.J. Room of the University Dining Centre, Sept. 26, 1991 (see Plate 2.90). Two award recipients were honoured: the Alberta Oil Sands Technology and Research Authority (AOSTRA) and Dr. Andrew H. Younger. The former's work and significant beneficial influence on industry and oil sands related research was reviewed by Gordon Moore in his laudation. It was the pleasant duty of the Department Head, Dr. R.A. Hedemann to acknowledge Andy Younger's 27-year continuous association with Chemical Engineering as an enthusiastic lecturer in two graduate courses, ENCH 607 and ENCH 609 treating natural gas processing principles and technology, respectively. Andy Younger's involvement in and contributions to the natural gas industry during his four decade-long highly successful career provided a rich background from which to draw interesting and challenging examples for his lectures. The popularity of his offerings is perhaps best illustrated by the fact that during the period 1977-1992, for which computerized records are avail-



Plate 3.6 Prof. P.F. Bischoff (R) with his workers Mrs. L. Pora and Mr. P.C. D. D. discussing the operation of a new circulation pump and its integration with the fluid equipment apparatus in background.

able ENCH 607 attracted 1028 enrollees an unprecedented registration statistic for a graduate level course

Involvement in national and international conferences either as participant or as organizer is also a highlight for the academic staff in addition to being an indicator of research activity. During the period under review a number of conferences and symposia were organized by the Chemical Engineering staff. For example, Drs F Berrut and A Chakma were co-chairmen and organizers of the 1990 CSChE Symp on *Heavy Oil Upgrading to Refinings*, held in Calgary May 9 1990. Dr A Chakma was also responsible for organizing 2 American Institute of Chemical Engineers (AIChE) symposia, the first on *High Efficiency Gas Absorbers* in Orlando Florida April 1990 in connection with AIChE's Spring Annual meeting; the second on *Enhanced Oil Recovery* organized as part of the AIChE Annual meeting Chicago, Nov 1990. Dr W V Svrcek acted as Programme Chairman and Editor for the Summer Computer Simulation Conference in Calgary July 15-18, 1990. The Canadian delegation to the CSChE (IChE (Indian Institute of Chemical Engineers) Joint Symposium on *Advances in Hydrocarbon Recovery and Processing*, held in Varanasi, India, Dec 18-22 1990, was led by Dr P R Bishnoi who also delivered a plenary lecture at that symposium. The



Plate 3.1 The inaugural holder of the Endowed Chair in Petroleum Engineering, Dr Roger M Butler, discussing with his group the development of a Vapex (Vapor extraction) process for the in situ recovery of heavy oils and bitumens, a project funded in the amount of \$428,213 over a 2 year period by CANMET, Canadian Centre for Mineral and Energy Technology, AMOCO Canada Petroleum Co. Ltd., Esso Resources Canada Ltd., PanCanadian Petroleum Ltd., Saskoil, Sincor Resources Ltd. and Shell Canada Ltd. with \$160,713 contributed by the industry consortium. The Chairholder also obtained funding through AOSTRA \$330,700 for 1988-9 and \$235,448 for 1991-44 and EMR/LES contracts \$299,762 for 1989-91. (Left to R) Mr J M Jones, Dr J Mokrys, Ms F Strait, Mr R Turner, sitting, Dr R Suprunowicz, Messrs Q Jiang, V Kanakia, S Jas hidden, Dr R M Butler and Mr G S Sawhney.

CSChE was formally represented in Varanasi by Dr A.K. Mehrotra.

Organizing and participating in conferences, however, takes but a fraction of the time the academic has to spend on research to obtain the data and results required for a meaningful contribution to the deliberations of such technical and professional meetings. During 1990-91 the Department's research activity was particularly impressive as we have

already seen from a number of indicators noted above. The strength and breadth of this research work is further demonstrated by the large number of research areas the Chemical Engineering academics are engaged in. To illustrate some of these areas we list the following research groups, their membership and specific research specializations:

- Biochemical Engineering is a major research activity for Drs. I.A. Behie and N.E. Kalogerakis, founders of the Pharmaceutical Production Research Facility, PPRF (see Plates 2.9 and 3.5), who are involved in the modeling, development, optimization and/or computer control of mammalian, insect and hybridoma-cell bioreactors and their use in the production of human proteins, polio vaccines, immunoglobulins and monoclonal antibodies. Dr A.A. Jeje is active in microcirculation of blood flow, soft tissue properties, biomechanics, electrophysiology and other topics in biophysics. Drs R.A. Hedemann, A.K. Mehrotra and M.A. Trebble are studying separation processes in biological systems.
- The kinetics of natural gas hydrate formation and decomposition and the deposition of hydrates in oil/gas pipelines are studied by Drs. P.R. Bishnoi and N.E. Kalogerakis (see Plate 3.6).



Plate 3.8 Members of the in-Situ Combustion Research Group are discussing the 1.8 m long (oil scale) physical model of a high-pressure combustion tube designed and built by Drs David Bennion, Gordon Moore and John Donnelly in 1974. The tube is fully equipped with heaters, thermocouples and taps and can operate at pressures up to 21 MPa (3000 psi), so as to simulate underground conditions associated with the recovery of light and heavy oils. The research is funded by AOSTRA, EMR and the private sector at approximately \$0.25 million/annum. (Left to R) Mr M.G. Jerserbach, Drs D.W. Hennrich, S.A. Mehra, rear, Miss N.M. Laberge, front, Mr M.M. Han, Mr D. M. Belgave, Miss T.S. Moore, Miss M. Duong, Dr R.C. Moore, Messrs S.C. Gupta, P.A. Gomez and H.X.

- The Group associated with the endowed Petroleum Engineering Chair headed by Dr. Roger M. Butler is involved in research dealing with in-situ thermal recovery processes for bitumens and heavy oils including the use of horizontal wells, steam-enhanced gravity drainage and a vapor extraction process, mechanisms of reservoir displacement processes and problems of oil sands production and utilization (see Plate 3.7).

- The In-Situ Combustion Group, comprising Drs. R.G. Moore, D.W. Bennion and J.D.M. Beirgrave (see Plate 3.8) are researching the recovery of conventional and heavy oils and bitumen from reservoirs and oil sands by means of in-situ combustion, the mathematical modeling of in-situ hydrocarbon recovery processes, the kinetics of in-situ combustion, thermal cracking and low temperature oxidation of conventional and heavy oils and related topics.

- The Environmental Engineering Group, including Drs. A. Badakhshan, M.F. Mohtad, E.L. Toffelson and M.A. Trebble are investigating problems related to water treatment, removal of organic waste materials from aqueous effluent streams, toxic waste disposal and emissions control in the chemical industry (see Plate 3.9).

- The Fluid Dynamics Group, consisting of Dr. A. Chakma, Mrs. M. Fogaras, Drs. A.A. Jeje, E. Rhodes,

P.M. Sigmund and J.F. Stanislaw (see Plate 3.10), are investigating hydrodynamic instability, rheology and multiphase flow in pipelines and porous media.

- The Thermodynamics Group, consisting of Drs. A. Badakhshan, P.R. Bishnoi, J.J. Havlena, R.A. Heidemann, N.E. Kalogerakis, A.K. Mehrotra, P.M. Sigmund and M.A. Trebble (see Plate 3.11) are dealing with many aspects of phase behaviour in hydrocarbon and non-ideal systems including the development of equations of state and other models, estimation of model parameters for equations of state, computational methods for phase and reaction equilibria and the collection of equilibrium data.

- The Physical Properties Group, including Drs. A.K. Mehrotra and W.Y. Svrcek (see Plate 3.12) are involved with the measurement and correlation of the thermodynamic and transport properties of heavy hydrocarbon/gas systems, viscosity prediction for immiscible systems, high pressure gas solubility and viscosity measurements and the behaviour of thixotropic fluids.

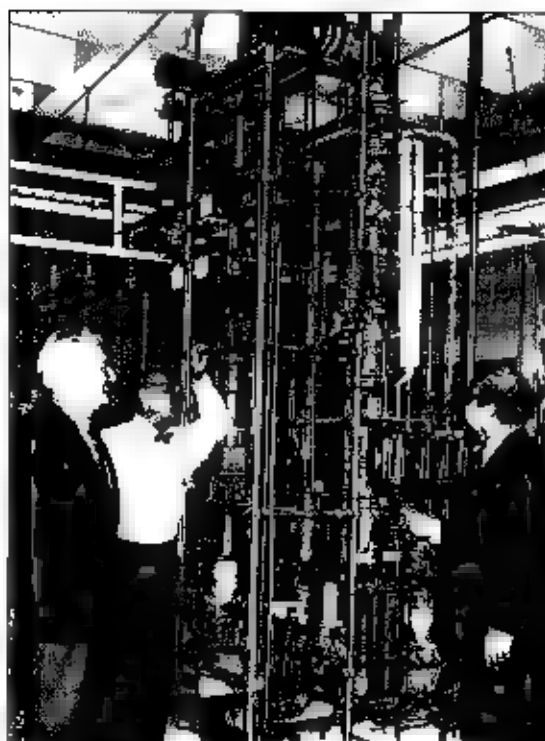


Plate 3.9 — Members of the Environmental Engineering Group discussing the performance of a novel single bubble-cap distillation column. L to R: Drs. E.L. Toffelson, M.F. Mohtadi and A. Badakhshan.

- Enhanced Oil Recovery is an area of research for Drs. A. Badakhshan, F. Berruti and A. Chakma in which they are studying the use of chemical thermal, microbial and immiscible flooding techniques.

- Fluidized Bed Reactors are of interest to Drs. L.A. Behie, F. Berruti, N.E. Kalogerakis, W.Y. Svrcek and E.L. Toffelson from the point of view of their fundamental behaviour and performance as well as their application in heavy oil upgrading, ultra-pyrolysis and as bioreactors.

- The Process Control and Simulation Group, consisting of Drs. P.R. Bishnoi, N.E. Kalogerakis, W.Y. Svrcek and M.A. Trebble are working on problems of computer simulation of distillation/absorption towers, control and simulation of chemical and petroleum processes, development of steady state and dynamic simulators, simulation and optimization of plant operations.

- Process Development and Processing of Hydrocarbons are main areas of research for Dr. E.L. Toffelson and his Group (see Plate 3.13), who are working on devel-

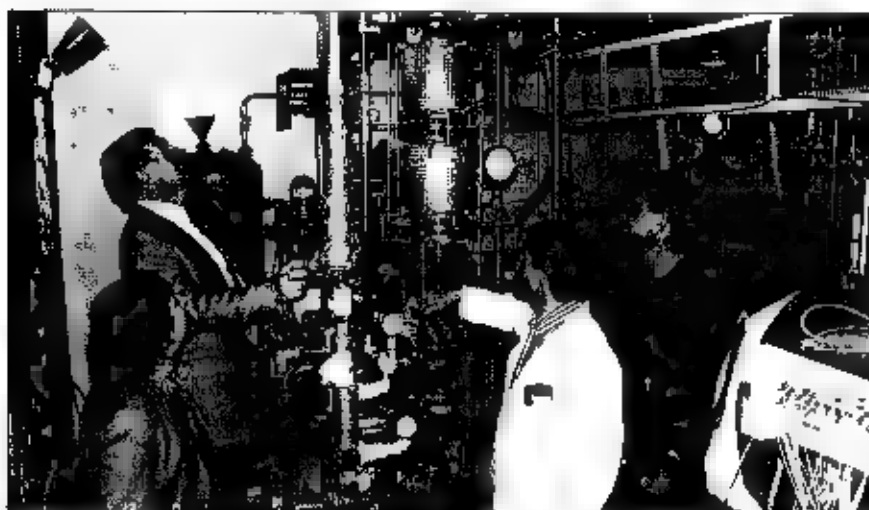


Plate 3.10 — Members of the Fluid Dynamics Group are examining the Gubator Process Equipment located in the Phase Separation Laboratory and used in the extraction of acid gas. L to R: Mrs. M. Fogaras, Dr. E. Rhodes, Mr. L.M. Dornan, Drs. J.F. Stanislaw and A.A. Jeje.

opment of processes for activation of Alberta coals, the removal of sulphur from oil sands coke, purification of natural gas containing hydrogen sulfide by catalytic oxidation, upgrading bitumen, heavy oil and pitch in the presence of catalysts and the effects of addition of pitch to a fluid coker.

- The Petroleum Reservoir Engineering and Simulation Group, including Drs J.D.M. Beigrave, N.E. Kariogerakis and J.F. Stanislaw are involved in computer modeling and simulation of reservoirs, automatic history matching in reservoir engineering and the use of pressure transient theory for the prediction of reservoir characteristics (see Plate 3.14).

In addition to the above indicated research areas, the staff is also active in a number of other specializations, including wax deposition problems in the production and transmission of waxy crudes, gas-solid reaction modeling, high performance gas/liquid contactors, instrumentation and control of coal-fired generators, foam fractionation and high temperature combustion of coke.

Such a broad spectrum of ongoing studies together with a record number of graduate students and co-workers and an all-time high level of external funding naturally resulted in a most impressive research performance with numerous outstanding events and initiatives, including the following highlights:

- The In-Situ Combustion Group re-



Plate 3.11 Members of the Thermodynamics Group are discussing the use of the Department's liquid-liquid extraction column in the recovery of propanoic acid from water with toluene. L to R: Drs M.A. Trebble, P.M. Sigmund, J.L. Havlena, R.A. Heidemann and F. Berruti.

ceived further international recognition when in 1990 with the support of AOSTRA (\$60,000 May-Dec '90) an agreement for a joint research project was signed with the Hungarian Hydrocarbon Institute, HHI. Funding came from AOSTRA and the Hungarian National Oil and Gas Corp. MOL Rt., the latter also receiving support from the World Bank. Direct contact between the research groups in Calgary and Hungary was initiated in 1990 through a 3 month visit to The U of C by Dr. Maria Toth, Senior Technical Expert at HHI. Collaboration was reinforced when Dr. R. Gordon Moore and two members of his Group, Dr. S.A. (Raj) Mehta and Mr. Matthew G. Lisenbach toured Hungary, May 7-29, 1991. While in Hungary they visited the key petrochemical industry related

technical centres, research institutes and universities and the major oil and gas fields and associated research laboratories and processing/testing facilities. They also made formal presentations on the in-situ combustion research at The U of C. The project is continuing with Maria Toth visiting Calgary from February 8-20 to be present at the in-situ combustion tube test on Thursday Feb. 13, 1992. She was back for a one week stay, June 6-12, and was accompanied on her return trip to Hungary by Drs. Moore and Mehta, who went on their second visit to that country, June 13-27, 1992.

- International recognition also came to Drs. P.R. Bishnoi and N.E. Kariogerakis for their research on gas hydrates. After receiving a 3 year \$120,000 NSERC Strategic Grant, they were successful in obtaining funding from Shell Research B.V. Amsterdam (\$40,000 over 2 years, 1991-93). This industry support was matched by a 2 year \$40,000 NSERC Industrially Oriented Research Grant, IOR. In addition, Prof. Bishnoi's research proposal was selected over a number of submissions from top US researchers for a 4 year U.S. \$280,000 contract (1991-95) with the Gas Research Institute, Chicago and the Gas Processors Assoc., Oklahoma. As if to underline these major international awards, Dr. Bishnoi was invited to participate in two workshops in Norway, as guest of the Norwegian Gas Industry, the first one at the Rogaland Research Laboratories.

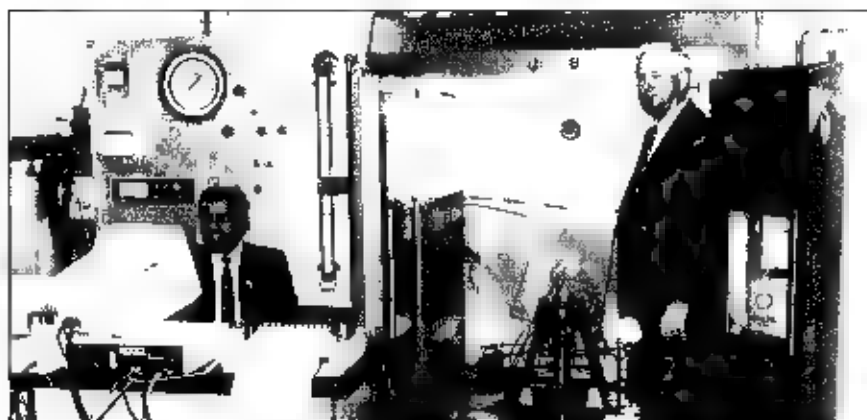


Plate 3.12 Drs. W.V. Svrcek (R) and A.K. Mehrotra in the Oil Sands Bitumen Properties Research Laboratory with some of their research equipment, a high pressure-high temperature phase equilibrium apparatus/chamber with computer-controlled automatic data acquisition-display recording instrumentation. Their AOSTRA/NSERC supported (\$75,000/annum) ongoing research programme deals with the behaviour and transport properties of bitumen-diluent mixtures.

Stavanger Aug. 5-6, and the second at The Foundation for Scientific and Industrial Research, the Norwegian Institute of Technology in Trondheim, Aug. 7-8, 1991. On the return trip he delivered an invited lecture at Shell Research Amsterdam on *Gas Hydrates-Industrial Challenges*, and spent a day in consultation with their technical staff on Aug. 14, 1991.

- During his sabbatical leave in June 1991 Dr. Franco Berrut renewed existing ties with colleagues at the Politecnico di Torino and initiated a joint research project in his area of specialization, the hydrodynamics of Circulating Fluidized Beds (CFB's). Collaboration was also started with Dr. J. Chaouk of Ecole Polytechnique, Montreal, on coupling the hydrodynamic model with chemical kinetics models for process simulation work which was of interest to DuPont de Nemours and Co., Wilmington, Delaware. A collaborative project involving The U of C, Ecole Polytechnique and DuPont was initiated for the development of scaling criteria for CFB's, using the validation of which uses data made available from a large scale industrial installation in France through collaboration with the Institut Français du Pétrole.
- In a most successful collaboration, Drs. L. A. Behie and F. Berrut designed and constructed a 20 bbl/day pilot plant for ultrapyrolytic visbreaking and upgrading of Alberta heavy oils. The high liquid yield low coke deposition



Plate 3.3 Dr. Eric L. Tollefson with his Group in the Environmental Engineering Laboratory are discussing the analysis of the products from the auto-oxidation of hydrogen sulfide in sour waste water. Funding obtained by Prof. Tollefson for 1990-91 exceeds \$186,000 including a \$150,000 AOSTRA grant to R. E. L. Tollefson, A. Majumdar and Dr. S. A. K. Datta.

process uses a novel invention, an Internally Circulating Fluidized Bed (ICFB) Reactor and a new technique based on the Curie Point Principle and involves the very rapid thermal degradation of heavy oils at low pressures (see Plate 3.15).

- A major AOSTRA contract (\$220,000, 1991-94) for Phase I of the study on the kinetics of ultrapyrolysis reactions of Alberta heavy oils was also obtained by Drs. L. A. Behie and F. Berrut. They use a microreactor coupled to a sophisticated gas chromatograph and mass spectrometer system for on-line analysis of the ultrapyrolysis products. Phase I was also funded by AOSTRA, a \$203,000 contract to Drs. L. A. Behie and W. Y. Surcek (1988-91). In May 1991 contact was estab-

lished with The M. W. Kellogg Co., Houston, Texas, concerning possible collaboration on ultrapyrolytic upgrading of heavy oils.

- Collaboration between Drs. F. Berrut and A. Chakma and Esso Resources Canada Ltd., ERC, continued during 1990-91. A fully equipped laboratory has been made available to the two researchers by ERC. The study deals with microbial transport through porous media and the utilization of bacteria for selective plugging of highly permeable zones in reservoirs to enhance oil recovery. The cooperative research agreement with ERC provides funding for the support of the student involved and for the equipment (see Plate 3.16).
- Dr. Amitabha Chakma has been very successful in obtaining funding for his research projects dealing with natural gas processing, enhanced oil recovery and heavy oil upgrading. His work on gas processing, including gas separation by immobilized liquid membranes and on amine degradation, has been supported by AMOCO Canada Petroleum Co. Ltd., AMOCO (\$40,000, 1990-92), the Canadian Gas Processors Assoc. (CGPA) (\$36,000, 1990-92) and through a 3-year \$243,000 AMOCO/NSERC Cooperative Research and Development (CRD) Grant (1990-92). Some of the results from the CRD-supported study were used by AMOCO in its Alberta gas plants, including the one at Vulcan. The gas chro-

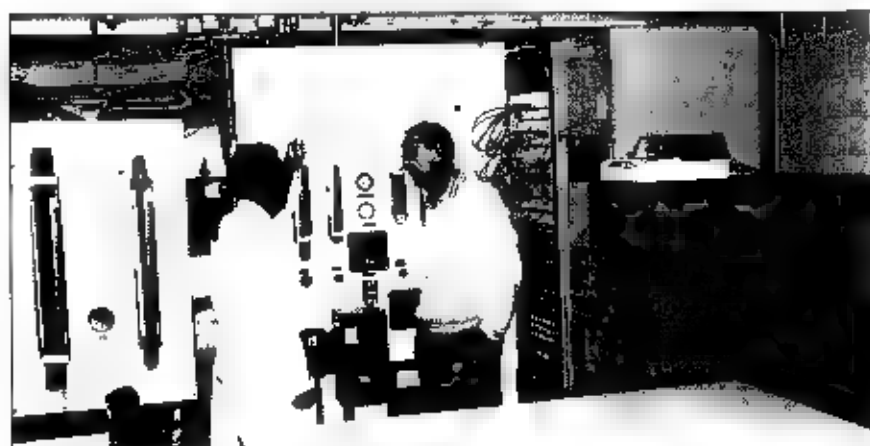


Plate 3.4 Drs. J.F. Stanislawski and J.D.M. Belgrave are discussing some results obtained by the automatic data-acquisition system from an experiment on a gas oil mixture using their model two-phase flow pipeline.

matograph technique for analysing solvents used in gas treatment and developed for CGPA has been made available to Canadian gas producers. His contributions to the gas processing field were recognized by a recent invitation for him to participate in the Int. Energy Agency's Greenhouse Gas R&D Programme as a member of the Expert Group on CO₂ removal from power plant flue gases. A 3 year \$245,600 contract (1989-92), with the Dept. of Energy, Mines and Resources EMR provided funds for scaled model studies on electromagnetic heating and inert gas injection in horizontal wells for enhanced heavy oil recovery from thin payzones, work for which EMR grant funds were also available. A project on simultaneous liquefaction of coal and upgrading of bitumen using molten halide catalysts was supported by Alberta Energy (\$70,000 1989-91). EMR research and NSERC equipment grants made his heavy oil upgrading studies possible. A joint project with Dr. I.F. Stanisav on two phase flow in deviated wells was supported by an EMR contract (\$20,000 over 2 years).

- During 1990-91 Dr. R. Gordon Moore continued to obtain massive funding in support of the in Situ Combustion Group. An industry supported EMR Research programme provided \$381,953 over a 3 year period (1989-92) with 8 industrial participants contributing \$105,000 towards the cost of this

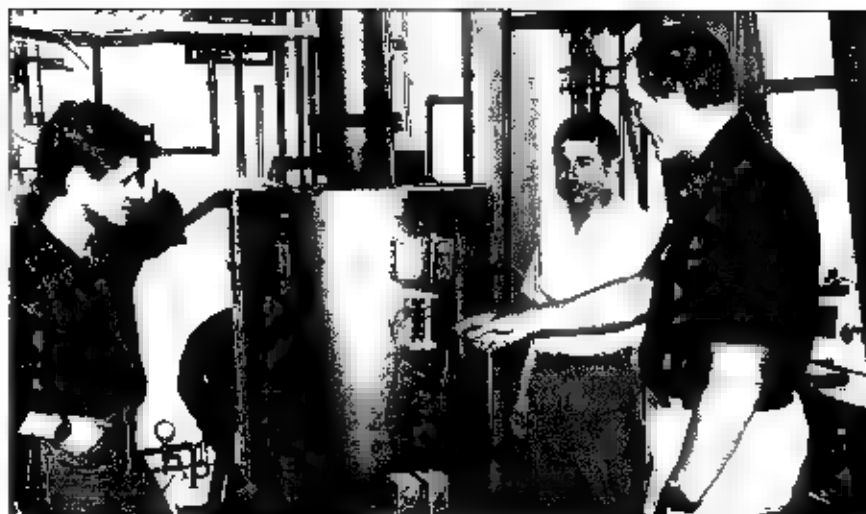


Plate 3.5 Drs. L.A. Behie, R. and F. Berruti (C) are planning an ultrapyrolysis test for upgrading heavy oils with their Research Assistant Mr. B. Milne using their invention, a novel Internally Circulating Fluidized Bed Reactor (ICFB). The reactor was developed and built with funds from a \$277,600 CANMET/Colt Engineering Corp. Contract, 1990-91.

study on steam assisted in situ combustion. A second major EMR supported project (\$212,070, Dec. 1989 - Dec. 1991) dealt with the in-situ combustion behaviour of the Ewehill Cummings Heavy Oil Reservoir. AOSTRA awarded a 3 year \$303,675 (1991-94) contract to Drs. R.G. Moore and J.D.M. Berruti for continuation of their fundamental and applied research on in-situ combustion recovery of heavy oils and bitumens.

- The most successful research operation in the Department and perhaps in the Faculty during 1990-91 was the Pharmaceutical Production Research Facility (PPRF) initiated by Drs. L.A. Behie

and N.E. Kalogerakis in 1989-90 with a start-up grant of \$169,000 from the Alberta Ministry of Technology Research and Telecommunication, TRT. A 3 year \$105,000 NSERC infrastructure grant awarded to Drs. Badakhshan Behie, Berruti, Kalogerakis, Mehrotra, Moore and Tolson (1989-91), together with a successful NSERC major equipment grant application for a \$100,000 flow cytometer helped the co-directors to establish their unique research facility in Discovery Place I (see Plates 2.9 and 3.5). Major contracts totaling nearly \$700,000 brought total funding for the Facility's first year of operation to near the \$1.0 million mark.



Plate 3.6 Drs. F. Berruti, R. and A. Chakma, C. are discussing details of an experiment with their MSc student Mr. C.B. Kowalski in the Microbial Enhanced Oil Recovery Laboratory located in the Research Centre of Esso Resources Canada Ltd. (ERL) in the University Research Park. Funding for the study and the equipment, (\$240,000) are provided by ERL.

- Dr. A.K. Mehrotra with Dr. W.Y. Svrcek as Co-Principal Investigator was awarded a 2 year \$60,500 AOSTRA research contract for thermodynamic and kinetic studies on asphaltene precipitation and flocculation in bitumens. The research duo was also successful with their \$89,617 NSERC major equipment grant application for a study on solid phase formation in hydrocarbon systems.
- Dr. M.A. Trebble continued to expand his research facilities with funding from two NSERC major equipment grants totaling \$111,601 for measurement of transport properties and kinetics of phase formation in supercritical fluid-organic solute systems.





Fig. 1. The Engineering Council during the 1970s and 1980s.

A NAME CHANGE

Tuesday May 28, 1963: Dr. George W. Govier's appointment as *Professor of Engineering (Part-time)* in the Division of Engineering at Calgary effective June 1, 1963 was approved by the Executive Committee of the Board of Governors. Minute #3. Three days later, on May 31, 1963, Dean of Engineering and Prof. of Chemical Engineering at the U of A, broadcasted effective. Thus George Govier became the first Chemical Engineering academic at the Calgary campus effective June 1, 1963. His title, *Professor of Engineering*, without departmental qualification was and remains unique in the faculty. It was formally selected by the Board and predecessor Dean R.M. Taylor to facilitate his continuing involvement

as the creator of the Engineering Complex and Faculty and to indicate the broad terms of reference which would enable him to interact freely with the Chairman or Dean, without departmental ties. George Govier's contributions to the planning and building of the Engineering Complex at Calgary prior to and after his arrival on this campus are briefly documented in Chapter I and Appendices C and D. With his broad academic background and administrative experience gained during his 23 years of involvement at the



Plate 3.17 The early Chemical Engineering 1967-68.

J of A. he naturally also impacted significantly on the development of our Department of Chemical Engineering particularly during its formative years and including its undergraduate and graduate programmes, research specializations and staffing.



Chemical Engineering – 1966-1981

The 1963-64 academic year was spent by George Govier in helping the Division Chairman, Dr. Adam M. Neville, to get construction on the first Engineering Building (the E Block) started and to obtain approval for the planned further Phases of the Engineering Centre. He also collaborated with Adam Neville in establishing objectives and an overall plan for the new undergraduate curriculum. It was during his second year at Calgary, 1964-65, and after Engineering was housed in the E Block, that the former Dean of the Faculty helped initiate chemical engineering graduate education and research at the new campus. He taught Ch. Eng. 588 *Fluid Mechanics of Complex Mixtures* to a class of 12 graduate and special students. A second chemical engineering staff member, Dr. A. H. Andy, Younger (see Plates 238 and 290), who was appointed Special Session Lecturer in Engineering in September 1964, presented Petr. Eng. 586 *Natural Gas Processing*, a course which was developed into 2 courses in 1970-71 that became the most popular and most heavily subscribed graduate courses in the Faculty. Although laboratory facilities were at a premium, chemical engineering research was started during that academic year by George Govier on the flow of complex fluids. He also collaborated with the newly appointed mechanical engineering staff member, Dr. J. E. S. Venart (see Plate 232) on a study of the vertical flow of a water-mixtures in which he became co-

supervisor of Mr Francis K. C. Yp, the MSc student involved in the project after April 1965. George Govier continued to provide planning and administrative assistance to the Dean and helped with the planning of the first year course, Engg 201 *Behaviour of Gases and Liquids*.

Construction on the Chemical Engineering Wing (the D-Block) began during the summer of 1965 (see Plate 3.18). Then, on Sept. 1, the first two full-time chemical engineering academics Drs. K. Aziz and D.W. Bennion joined the Faculty as Assistant Professors (see Plate 2.38 and Fig. 3.4). They arrived just in time to help launch the first year programme of the new undergraduate curriculum. Khalid Aziz lecturing to large classes in Engg 201 during both terms and Doug Bennion offering a new graduate course, Engg 687 *Fluid Flow in Porous Media* in the Fall, and a second year course of the *old programme* to a group of sophomores during the Winter term. Both of them also started their research and obtained their first NRC grant.

During the winter term of 1966, the appointment of Dr. Robert A. Ritter as inaugural Head of the Department of Physics July 1, 1966, was announced. He was welcomed as visitor at the 8th meeting of Engineering Faculty Council on March 30, 1966 (see Pages 244 and 317).

The Department officially came into existence on July 1 1966. It was one of the two departments for which a Head had been appointed prior to that date its home the Chemical Engineering Wing (D. Bock) was nearing completion with occupancy slated



R. G. Ald



Ms. A. Ms. B. and



F. J. Beckwith

Public 1966-67 1967-68 Engineering appointees 1966-67

for August. The new facilities had to be shared with Mechanical Engineering until the B Block came on stream a year later.

From the moment of its inception, the Department's growth rate and activity swung into *high gear* due in no small measure to Bob Ritter's entrepreneurial approach and dynamic leadership. Within 3 days of taking office, he found and hired the first Departmental Secretary, Mrs. Marion Nielsen who was succeeded on Jan. 1, 1967 by Mrs. Carol J. Jørgerslev (see Plates 3.17 and 3.20). He also hired the Department's first technician, Mr. Walter Eastwood, on Dec. 5, 1966. Finding the right person for the position of Technical Supervisor took a bit longer but he finally decided to hire Mr. Malcolm Keller from California effective Jan. 24, 1967. Only a month later Mr. V. L. Kraus joined the Department who was to become Mac Keller's successor serving the Department as Technical Supervisor till 1996 (see Plates 3.17 and 3.32). Within a year the new Head succeeded in building a 9 member support staff consisting of 5 technicians and 4 secretaries including Messrs. Walter Eastwood, Malcolm Keller, Vincent L. Kraus, Ron Eaton, Rudy Banert and Mmes. Carol J. Jørgerslev, Joyce Mills, Lucy Roxburgh and Carol Plier (see Plate 3.20). Mr. David Turnbull joined the Head as Research Assistant on Oct. 1, 1967 and stayed with him until June 30, 1974.

The academic staff in Chemical Engineering also grew very rapidly during the first 2 years of the Department's operation (see Fig. 3.4). Soon after his arrival, Bob Ritter appointed one of his PhD students, Dr. H. Andre as



Police of York and the Metropolitan Police of London staff
for the 30th March 1954 in the Roxburgh and Piller
Houses

Assist. Prof. effective Aug. 1, 1966 (see Plate 2.44). During the academic year, he also succeeded in attracting and appointing Drs. M.F. Mohtad and E.L. Tolletson as Prof. and Assoc. Prof. respectively with the former arriving on July 1 and the latter on Sept. 1, 1967 (see Plate 3.19).

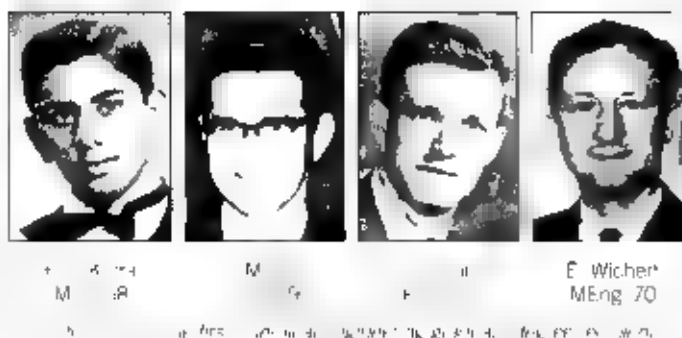
Departmental status and the arrival of Bob Ritter also signalled the start of a most dramatic growth in graduate enrolment (see Fig. 3.3). Suddenly there were 7 full-time graduate students in Chemical Engineering in the Fall of 1966, namely Messrs. N.L. Arison, R.G. Acid, J.P. Batycky and G.S. Whitfield in PhD and D.G. Coley, P.S. Karra and A.S. Telford in MSc programmes. The 4 PhD students and D.G. Coley were Bob Ritter's students at the U of A who decided to go with their supervisor and transferred to The U of C during the summer of 1966. Messrs. Karra and Telford were supervised by Drs. Aziz and Bennon respectively, the former student also receiving credit for some courses taken at the U of A. In addition to this full-time graduate enrolment there were 17 students registered in Postgraduate Diploma programmes and 62 special students taking one or more of the 7 Chemical Engineering graduate courses available during 1966-67 including 3 new offerings. One of the special students, Mr. P.H. Hoist had completed his MSc at the U of A in 1965 and took Andy Younger's *Natural Gas Processing* course during 1966-67 before becoming a full-time PhD student in April 1967 under the

supervision of Dr. Aziz. He was to become the first PhD graduate in Chemical Engineering from The U of C (see Plate 3.21). One of the Dip. students was Mr. Ian Martin who was first to obtain this degree in Chemical Engineering (see Plate 3.21).

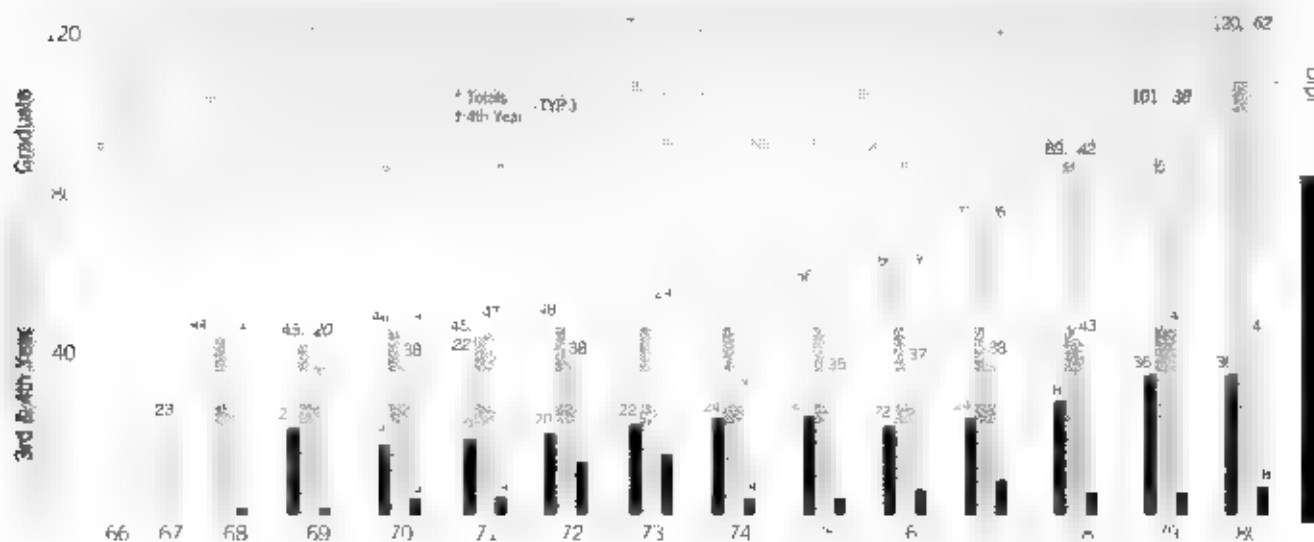
To meet the Department's increased teaching commitments resulting from the introduction of the 2nd year of the new engineering curriculum in Sept. 1966 the new Head was forced to call upon his senior PhD students appointing Robert Auld as Sessional Instructor for a year effective Sept. 1 (see Plate 3.19), and making Jim Batycky and Norm Arison Graduate Teaching Assistants for the 1966-67 academic year.

Chemical Engineering graduate education and research activity at Calgary was given strong endorsement with the Faculty of Graduate Studies granting approval to the Department to offer MSc and PhD programmes in the areas of Systems Engineering and Rheology.

A further significant event of the 1966-67 academic year was the establishment of the *Petroleum Research Institute PRRi*. For formation of such an institute was first



suggested in 1964 in a proposal submitted to industry and government for discussion and prepared by Dr. G.W. Gullett, Chairman of the Oil and Gas Commission Board, Dr. E.J. Wiggins, Director of the Alberta Research Council and Dr. R.M. Hardy, Dean of Engineering at the U of A. As a result of the positive response to the proposal from the petroleum industry and the Alberta government, it was decided during the spring of 1966 to launch such an undertaking, the purpose of which was 'to conduct fundamental research directed toward increasing the recovery of oil from underground reservoirs'. Dr. Necmettin (Nick) Mungan was appointed as the inaugural Chief Research Scientist of PRRi (see Plate 3.22) effective Nov. 6, almost a month prior to the official incorporation of the institute on Dec. 2, 1966. It was in Jan. 67 before partitioning of space on the 3rd floor of the newly completed D-Block was completed and Nick Mungan was able to move upstairs from his temporary quarters in the Faculty office. With annual



Funding from the government and industry, PRR began its R&D activities under the direction of Dr Mungan and with the approval of a Board of Directors the membership of which included the Dean of Engineering. Although independent of the Faculty and the Department close cooperation developed between the Institute and its host, with the staff of the two units collaborating and interacting on various projects to their mutual benefit. Within a year Nick Mungan hired his first research staff namely Mr Frank G. McCaffery and Dr Hing Y. Lo the first of whom was to become a



Dr Nick Mungan, first Director of the Petroleum Recovery Research Institute, PRRi. 1967 respectively (see Plate 3.23). Dr Mungan guided the activities of PRRi until April

1978 when it developed into an important resource for the petroleum and natural gas industry of the province. In December 1974 its name was shortened to *Petroleum Recovery Institute, PRRi*. It moved into its present quarters in the Energy Resources Research Building in the University Research Park in Dec. 1979, vacating the 3rd floor of D-Block after 13 years.

The third year of the Chemical Engineering programme was inaugurated in the Fall of 1967 session with a class of

23 students. The arrival of Drs. Mohtad and Toilefson during the summer of 1967 was timed perfectly to provide help with the increased teaching load. Thus for example, Matt Mohtad was scheduled to teach two of the new 3rd year courses *Chemical Engineering Fundamentals* and *Chemical Engineering Thermodynamics* in the Fall and Winter terms respectively. Eric Toilefson began his long standing involvement with *Inorganic* and *Organic Chemistry* courses he has taught to engineering students for a quarter century.

Graduate teaching and research activity continued to expand very rapidly with 7 new students doing the total graduate enrolment comprising 7 PhD, 5 MS and 2 MEng registrants. The new students included Messrs P.H. Holst, A. Economopoulos and K.J. Bradley in PhD, H.G. Durran and G.B. Frame in MSc and K.C. Milne and E. Wchert in MEng programmes respectively. Mr F.A. Quresh joined Ian Martin as the second Diploma student in Chemical Engineering. The required office and laboratory space became available when Mechanical Engineering vacated its temporary quarters in the D-Block and moved into its own Wing (B-Block) in August 1967.



Dr. Nick Mungan, first Director of the Petroleum Recovery Research Institute, PRRi. 1967 respectively (see Plate 3.23). Dr Mungan guided the activities of PRRi until April 1978 when it developed into an important resource for the petroleum and natural gas industry of the province. In December 1974 its name was shortened to *Petroleum Recovery Institute, PRRi*. It moved into its present quarters in the Energy Resources Research Building in the University Research Park in Dec. 1979, vacating the 3rd floor of D-Block after 13 years.

In anticipation of continued growth in graduate enrolment and with the planned introduction of the 4th year programme in Spring 1968, Bob Ratter spent much of his time during 1967-68 in staff recruitment. He appointed Dr Donald Flock as Prof. of Chemical Engineering effective Jan. 1, 1968. Dr Robert A. Heidemann as Assoc. Prof. and Drs. John K. Donnelly and Gary A. Gregory as Asst. Prof., effective Sept. 1, 1968 (see Plate 3.24).

At Spring Convocation on Monday May 27, 1968, the Department saw its very first graduate, Mr P.S. Karra receive his MSc degree (see Plate 3.21), with Mr D.G. Colley also an MSc. candidate becoming the second Chemical Engineering graduate at the Fall 68 convocation (see Plate 3.25).

A most significant event for the Department was the appointment of Dr R.A. Ratter as Dean effective July 25,

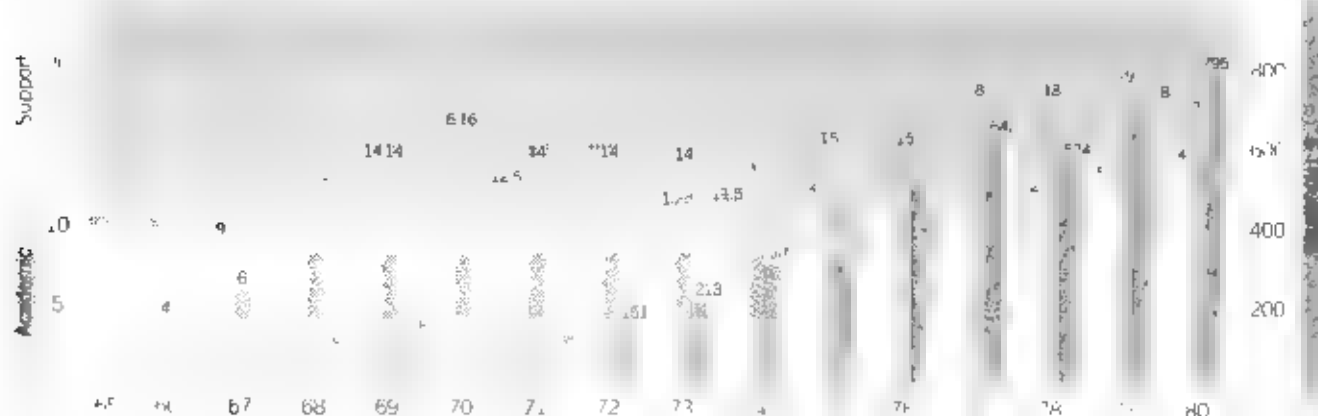


Fig. 3.4 Full-time Academic and Support Staff and Annual External Research in Chemical Engineering 1965-1980



J. K. Donnelly



D. L. Flock



G. A. Gregory



J. Havlena



R. A. Heintzelmann



R. Rice



F. Stannett

Plate 3 24 Further new academic staff 468

1968 (see Plate 3 26). Four days later Malcolm Keller left to return to California and Vince Kraus became Technical Supervisor. The new Dean also decided without much delay on his own successor and appointed Dr. M. F. Mohtadi as the second Head of Chemical Engineering, effective Aug. 1, 1968 (see Plate 3 27).

Matt Mohtadi's first appointee was Dr. Jaroslav F. Sanislav who joined the Department as Visiting Lecturer on Sept. 15, 1968. Six weeks later on Nov. 1, Dr. Jan J. Havlena (see Plate 3 24) was hired as Research Associate of the Environmental Engineering Group which included Drs. Aziz Mohtadi and Tolefson.

In September 1968, the 4th year programme was started with 21 students in the first senior class. There were 23 juniors in Chemical Engineering that Fall. With 12 full-time, 3 part-time and several sessional staff at the start of

classes, the Department was able to include 3 new courses in its list of 10 graduate offerings in addition to looking after the full departmental undergraduate programme and its share of the common core teaching load. Additional help came on Dec. 1, 1968 with the arrival of Dr. Richard G. Rice who had been hired as Assist. Prof. by Bob Ritter during the last few months of his tenure as Head (see Plate 3 24).

Graduate enrolment almost doubled again, increasing from 14 in Sept. 67 to 26 in the Fall of 1968. There were 10 PhD and 5 MSc students in course, including Messrs. Y. P. Gupta, F. C. McCaffery and M. P. Wenkoff and Messrs. A. Lamb and P. N. Rao as new registrants in the former and latter group, respectively. The new part-time MEng programme was also beginning to impact on graduate enrolment, increasing the number of part-time students from 2 in 1967 to 11 in 1968.

The 13 member support staff consisted of 8 technicians and 5 secretaries. There were also 4 research assistants active in the Department including Ms. Eva Pichert, a new immigrant from Czechoslovakia (see Plate 3 28).

The 3rd year programme was modified slightly during its second year of operation by replacing a chemistry course with a course on chemical process development thereby enhancing the Chemical Engineering content of the curriculum.

The wide graduate laboratories were completed during the aca-

demic year and new research laboratories for control and environmental engineering were established. The buty acetate pilot plant (see Plate 3 29), a sophisticated and complex chemical system was brought on stream at the end of March 1969 and



Plate 3 25 Dr. R. A. Rice dressed in academic regalia 468-69

used for undergraduate instruction and research in systems and control kinetics and mass transfer. Coupled with the EA 680 hybrid computer control system, the plant provided an advanced tool for chemical engineering research.

The Department's early research developed mainly in 3 areas: (1) Systems and Control; (2) Flow through porous media; (3) Environmental Engineering. In addition to the increase in academic and support staff, research associates, assistants and facilities, the growth in research activity is underlined by the 56% increase in



Plate 3 26 The second graduate in Chemical Engineering, Mr. Donald G. Collier, is using a continuous optical photographic process in his MSc studies dealing with the separation of gas mixtures including hydrogenation gases 467-68

external research funding from 1967 to 1968 (see Fig 3.4).

The senior year programme was enhanced by assigning students to projects. E.g. 504 Process and Equipment Design. Areas of cooperation with more than 10 specialists from the oil and gas industry who served as special lecturers and advisors. The subject of the process design exercise was the manufacture of synthetic crude from Athabasca oil sand. The process analysis for the project was carried out using the newly completed butyl acetate pilot plant. The senior class visited a petroleum refinery in the north to get impressions of the industrial environment.

In January 1969, the 11th Chemical Engineering Annual Dinner was held. Mr. Earl Jones, Vice-President of The Hudson Bay Oil and Gas Co. was the invited speaker who announced a new annual award, a gold medal and book prize, to the best all-around 3rd year student in Chemical Engineering.

A total of 21 members of that first senior class graduated on May 26, 1969 (see Plate 3.70), one student, Mr. John Paul Alexander, was, with distinction, as a result of which he was chosen as the first recipient of the Association of Professional Engineers of Alberta, APEA, Gold Medal in Chemical Engineering. The inaugural winner of the Society of Chemical Industry Merit Award was Mr. William Kent Oliver. At the same Spring Convocation, Dean Ritter also presented the first two Post Graduate Diplomas in Engineering, one to a chemical engi-



M. M. J. Norton G. McDuffie R. G. Moore R. L. Rowe R. H. Weiland
Plate 3.27 The second Head of the Department of Chemical Engineering with some of his appointees 1969-70

neering student, Mr. Ian Martin (see Plate 3.21).

The Fall '69 3rd and 4th year classes numbered 23 and 20, respectively. Graduate enrolment rose to 31 students, including 12 PhD, 11 MSc and 1 MEng full-time and 7 part-time registrants. The academic staff increased with the appointment of Drs. Norton G. McDuffie as Assoc. Prof. and Richard D. Rowe as Assist. Prof. effective Sept. 1, 1969 (see Plate 3.27). Dr. A. H. Yonger's appointment was changed to Prof., Part-time, also effective on the same date. Dr. Donald J. Erickson signed to become Assoc. Dean at the end of Aug. Sept. 1, 1969. During the academic year, Dr. A. L. Johnson, Prof. and Head of Chemical Engineering at the Technical University of Norway, Trondheim, arrived and was named Visiting Prof. for the period April to April 1970. Dr. J. G. Jones, Assoc. Prof. staff, initiated the departure of Carl G. Jones at the end of November, being succeeded as Departmental Secretary by Mrs. Diane Jorgenson on Dec. 1, 1969.

As part of the Faculty curriculum review, the Department modified both the 3rd and 4th year programmes.

From Sept. 1971, the senior students in Chemical Engineering were exposed to 3 new engineering courses: *Operations Research*, a new 4th year common core course and 2 new departmental courses: *Unit Operations* and *Reservoir Engineering*. An elective course in Chemistry or Biochemistry was also included in their revised programme. The 3rd year group again visited a chemical plant in Edmonton while the senior class faced an ambitious design project, the planning and design of a com-

plete gas plant. The project involved 14 guest lecturers from industry.

Plans were finalized for a Chemical Engineering Teaching Laboratory which would combine and coordinate unit operations type experiments. New research laboratories for air and water pollution and an Analytical Environmental Laboratory were established, the latter with the help of the Environmental Sciences Centre, Kananaskis. An NRC major equipment grant to Richard Rowe facilitated the purchase and installation of a laser-Doppler turbulence meter for studies in the simulation of environmental flows. A special X-ray laboratory was planned for research in flow through porous media for which the X-ray apparatus was received and installed during the academic year.

The Department increased its graduate course offerings from 10 to 12, including 3 new courses: *Adv. Systems Eng.*, *Environmental Eng.* and *Hybrid Computation*. In addition, Drs. Aziz & Bennion offered a *Reservoir Simulation* course to the Petroleum Society of CIM. Drs. Toefson, Mohtad, Havlena, McDuffie and Rowe offered a 5 day short course on *Air and Water Pollution* in Banff, May 4-8, 1970, and courses on *Natural Gas Processing*, *BioEngineering* and *Applied Statistics* were also offered during the spring term of 1970.

The appointment of Drs. R. G. Moore and R. H. Weiland as Assist. Prof. effective Aug. 1 and Sept. 1, 1970, respectively (see Plate 3.27), brought to an end the period of rapid growth. The university funded support staff increased from 14 to 15 with the addition of one technician (see Fig. 3.4). A further technician was supported from external funds.

Total undergraduate and graduate enrolment continued to increase in Sept. 1970. The junior and senior classes numbered 27 and 19, respec-

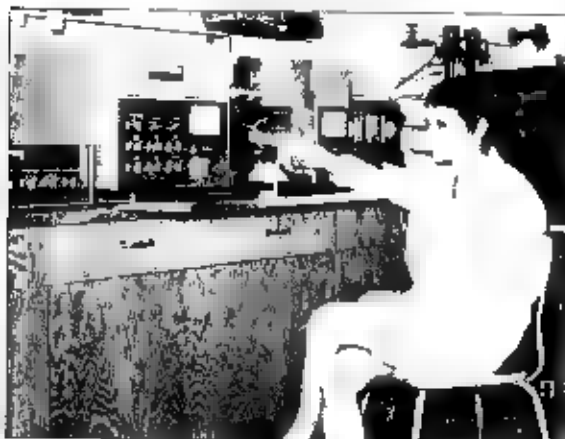
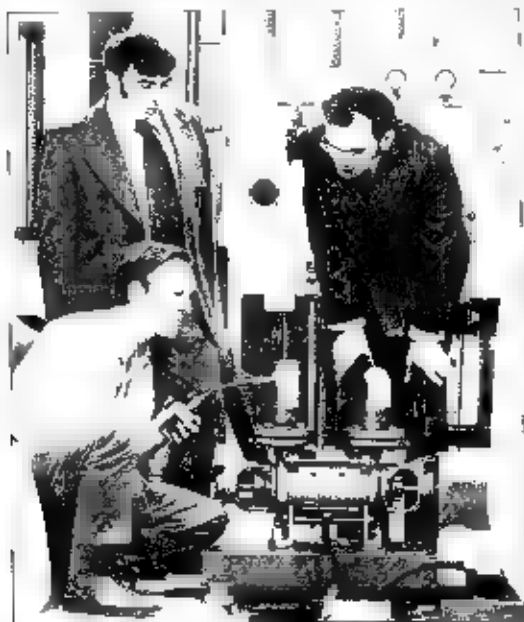


Fig. 3.4 The new Environmental Engineering Laboratory, 1970-71

A 20-page book review of the
of the 1970-71 winter
1971-72. The book is
by the American
Book Review



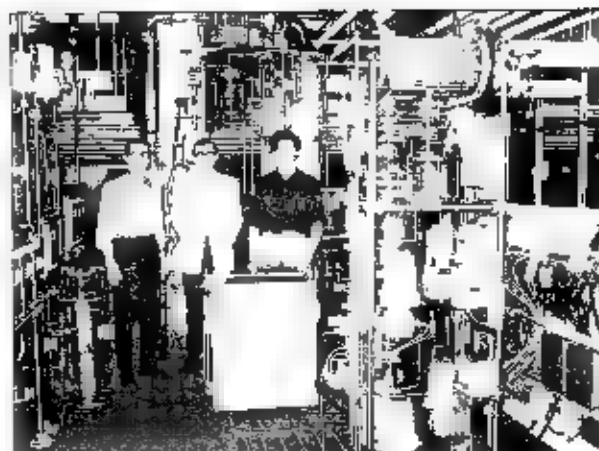
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dar, Nigeria as special consultant in connection with the establishment of a technical university. Dr. M.F. Mortad was chairman of the very successful session of Theoretical and Applied Mechanics, ITAM Symposium on Flow Through Pipes, Madras, India held 23-28 May 1974.

During the spring, Drs. R. H. Weiland and E. G. Rieckas gave a collective effort and Aug. 1, 1967, reformed the Department Head. Mr. Moran was kept on June 30 before going on sabbatical leave to Oxford. Dr. Eric L. Tollefson became Acting Head for the period July 1, 1971 to June 30, 1972, an appointment which was subsequently renewed to June 30, 1976 and then renewed for a second 5 year term, see Plate 3.33. Thus began the Tollefson decade, a period of stability in the Department's administration which has lasted steadily through the 1970's. Despite continuing and now continued annual budget problems,

The Spring Term 1992, I saw the student union in Cleeve College during Mr. Gailan Olwyne E. Jones Clark receive her BSc degree. At the same time, Geoffrey Whitfield became the Department of Education and Training's first student to receive a BSc degree.

With 2 resignations and one withdrawal, the board had to leave the new Health Authority vacant since the temporary replacement appointed Dr. P. J. M. Sgarbi, a staff member at PERI, as just time Session 1989. In effect, on Sept. 1, 1989, the Health Policy and Financing Committee's undergraduate leadership, which was started the previous academic year, was still in place and been granted tenure. He also changed Jarosav St. Nicholas appointment from visiting lecturer to an adjunct clinical instructorship effective June


$$\begin{aligned}
 & \text{Let } \mathbf{A} = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \text{ and } \mathbf{B} = \begin{bmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{bmatrix}. \text{ Compute } \mathbf{A} + \mathbf{B}. \\
 & \text{Solution: } \mathbf{A} + \mathbf{B} = \begin{bmatrix} 1+9 & 2+8 & 3+7 \\ 4+6 & 5+5 & 6+4 \\ 7+3 & 8+2 & 9+1 \end{bmatrix} = \begin{bmatrix} 10 & 10 & 10 \\ 10 & 10 & 10 \\ 10 & 10 & 10 \end{bmatrix}.
 \end{aligned}$$

In 1971, an appointment which was upgraded to the Assist. Prof. rank two years later. Finally he continued to rely on Jan Havlena's heavy involvement in the undergraduate curriculum, particularly in Engg. 201 laboratories and Math. 209 tutorials and recognized his significant contributions in this area by appointing him Senior Demonstrator effective Sept. 1, 1972.

and the necessary staff for the Department's undergraduate and graduate teaching load was but one of the Acting Head's problems. After an initial budget reduction during the 1970-71 academic year, the government's increased financial restraints dictated tightening budgets on the university and led to the first major budget cuts in Engineering. In Chemical Engineering as in other departments, the short fall in funding was met by reductions in support staff, sessionals and GTA's (see Fig. 3.4).

Despite the decrease in resources, graduate student numbers continued to grow, reaching a departmental peak in the Fall of 1971 which was to stand as a record for the next decade. There were 47 registrants that Fall including 13 PhD, 21 MSc and 2 MEng full time and 11 part time students. The 3rd and 4th year class sizes remained static, numbering 24 and 22, respectively (see Fig. 3.3).

The continuing high graduate enrollments began to yield *dividends* in the form of a substantial increase in the number of graduate degree recipi-

ents. Thus, in comparison with a PhD class of 3 MSc graduates in 1971-1972 saw 4 PhD and 9 MSc students graduate from Chemical Engineering including such early registrants as PhD candidates R.G. Auld (see Plate 3.34), N.L. Arison, J.P. Balycky and K.L. Bradley (see Plate 3.35) and MSc graduates A.S. Tetford. Also, at the Summer Session of 1972, Mr. A. J. [unclear] became the Department's second and the Faculty's 4th Ph.D. diploma recipient in 1973, 6 PhD, 9 MSc and 1 MF graduate.

From 1967 and till 1992, with regard to the total number of graduate degrees and the number of PhD degrees awarded annually respectively:

One of the 6 PhD graduates in 1974 was Annid M. [unclear] 1976 who distinguished himself also by winning 2 best student paper prizes, the first at the Annual Meeting of the American Control Association held in [unclear] and the second at the [unclear] 1977.

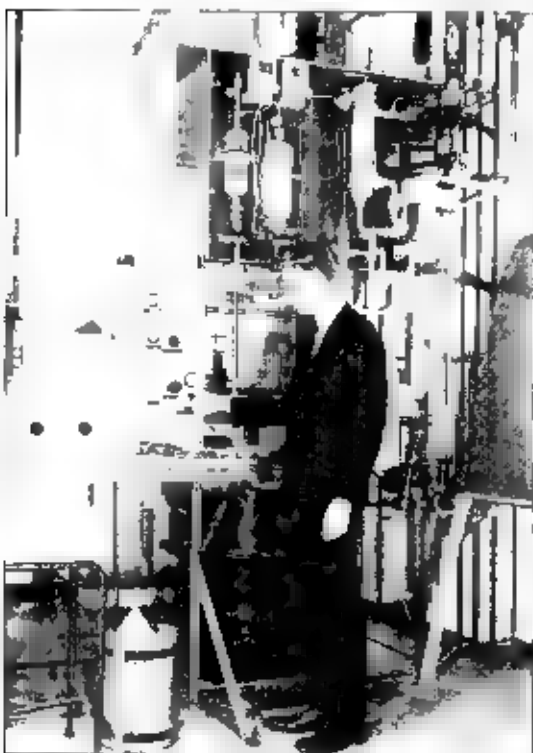


Figure 3.36: [unclear]

note the NRJ Senior Industrial Fellows Award to R. Charbonneau for the period July 1971 to June 30, 1973, while he was at Western Engineering and Development.

An examination of the department's enrolment in the 1970s shows that the number of students enrolled in the department during the 1970s was 175, with a peak of 175 in 1974.

Figure 3.37 shows that graduate enrolment in the 1974 peak until they started to rebound in 1974, undergo a significant drop in 1975, and then a steady increase in 1976, 1977, and 1978. The number of degrees awarded from the department levels but remained static for the remainder of the decade.

In conclusion, the view of the department's graduate enrolment and degrees awarded shows that the number of students enrolled in the department during the 1970s was 175, with a peak of 175 in 1974. The number of degrees awarded from the department levels but remained static for the remainder of the decade. In conclusion, the view of the department's graduate enrolment and degrees awarded shows that the number of students enrolled in the department during the 1970s was 175, with a peak of 175 in 1974. The number of degrees awarded from the department levels but remained static for the remainder of the decade.



Figure 3.37: [unclear]

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After being confirmed in his position as Head effective July 1, 1972, E. Folletson continued to look for suitable candidates for the Department. After examining some difficulties in recruitment, he decided at the time that the department was in a position which would face a significant remainder of his term. He surely could not suspect that in the following 9 years he would have to appoint over 30 full-time and sessional academic and 43 support staff members to replace the 13 continuing and



From left to right: H. E. Andre, E. Toiletsen, H. E. Andre, H. E. Andre, M. Fogarasi, L. Malta, W. V. Svrcek
 Professors, Faculty of Chemical Engineering, with new academic staff members, 1972-77

sessional academic and 47 support staff who became unavailable for teaching assignments retired, resigned or were laid off. This unprecedented staff turn-over was due primarily to the disparity in institutional and industry salaries and wages resulting from the economic boom which existed in Alberta's oil patch during the 1970's and which was triggered by the 1973 energy crisis.

After upgrading the appointments of Drs. Havlena and Staroslav into tenure rank positions, Eric Toiletsen's next staff addition was also an *in house* appointee. During the summer of 1972 Jim Batycky, one of the first four PhD candidates in the Department completed a degree requirements, won a J of C Post Doctoral Fellowship and was appointed a Post Doctoral Teaching Fellow effective Sept. 1, 1972 (see Plate 3.33).

The Fall '72 term brought additional staffing problems for the new Head, Harvie Andre, who ran as the Progressive Conservative candidate in the Calgary Centre Constituency, won the seat in the Oct. 30 federal elections and went to Ottawa. It became clear that his sabbatical leave Sept. 1, 1972 - Aug. 31, 1973 would likely be

followed by an indeterminate period of *political* leave. In fact, Dr. Andre has had a distinguished political career since then, having represented the same constituency since 1972 and having held various portfolios in the Mulroney PC Cabinet. He continues on political leave to date (1992).

The programme changes instituted as a result of the Faculty's and the Department's curriculum review of 1967, also permitted a reduction in the total course load of the 3rd and 4th year Chemical Engineering programme. Starting in September 1973, junior and senior students in the Department were taking 5 instead of 6 courses in each of the Fall and Winter terms. In addition, the laboratories were redesigned so as to affect a decrease in those contact hours as well. The changes were also designed to help emphasize process development and design related to Alberta's natural energy resources. At the graduate level, an MEng programme in Petroleum Engineering was introduced with requirements identical to those of the existing MEng degree except for core courses. With an emphasis on process design, the Department was looking for an expert in this field and was successful in hiring Dr. Norman E. Anderson as Assoc. Prof. effective Sept. 1, 1973 (see Plate 3.33).

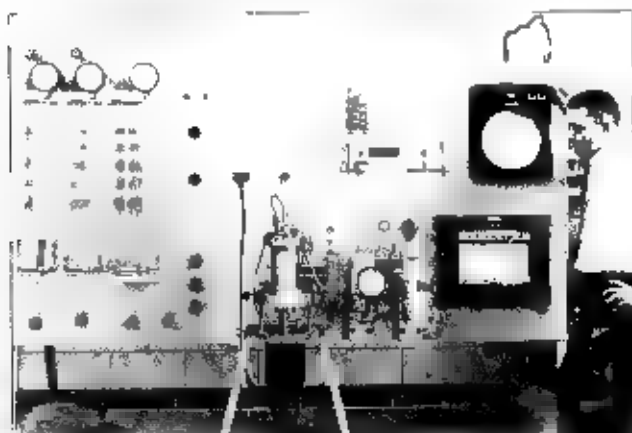


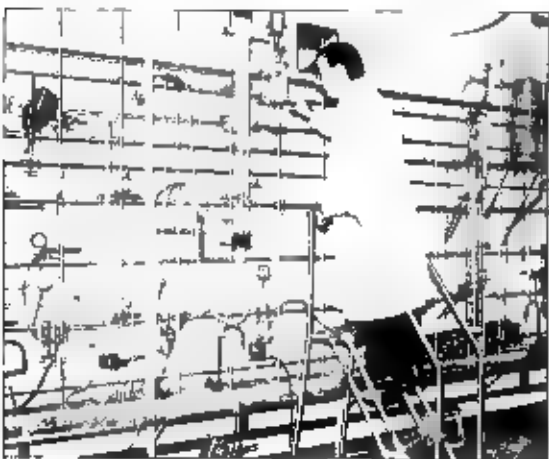
Figure 3.34: A laboratory setup for the study of the low properties of thin films.

With a decrease in departmental undergraduate course load and with two new staff members in the fold, the start of the Fall '73 term looked good from an administrator's viewpoint. However, during the fall and winter, a number of staffing problems

surfaced. Jim Batycky resigned and left on Dec. 31, 1973. During the spring of 1974 it became clear that Bob Ritter was considering resigning his positions as Dean and Professor to devote full-time to his newly formed company and the marketing of his invention. The resignation of Dave Turnbull as the Dean's Administrative and Research Assistant effective June 30, 1974 was followed by that of Bob Ritter's effective Aug. 31, 1974. Turnover in Head Secretaries added to the Head's administrative problems. It began with the resignation of Diane Jorgenson who left the Department after 4 years, on Dec. 16, 1973. Her successor, Sandra Aspdien, who was hired as Departmental Secretary effective Jan. 2, 1974, was replaced by Mar. Anna McCargar on May 21, 1974. She stayed for 16 months when Pat Allen, who had been with the Department since Jan. 3, 1972, took on the responsibilities of Head Secretary effective Oct. 1, 1975. Stability in this administrative position returned, at least for a while, when Jean Donahue became Departmental Secretary on Dec. 15, 1975, after Pat Allen had left at the end of November.

The ongoing search for academic staff was intensified during 1974-75 and resulted in the appointment of Drs. P. R. Bashno and W. V. Svrcek as Assoc. Professors, effective Aug. 25 and Sept. 1, 1975 respectively (see Plate 3.33). Mar. A. Fogarasi's increasing involvement in and contributions to the teaching of the undergraduate programme was acknowledged by appointing her instructor II as of Sept. 1, 1975 (see Plate 3.33). With these appointments the Department's continuing academic staff shortage was somewhat alleviated despite the resignation and departure of Norman Anderson on June 30, 1975. To the Faculty's and the Department's regret, George Govier also decided to leave at the end of September after being involved in the building of our Complex

In addition to helping up the oil and gas economy, the energy industry is expected to bring into the country new, increased employment and development work to establish technologies for the efficient economic and environmentally safe recovery of Alberta's vast oil sands energy resources. The two organizations were created in the mid 1970s with the help of the federal government. The first was created by the federal government, and the second by the provincial government. The first was the Alberta Chemical Engineering and Research Institute, which was established by an act of the Legislative Assembly on June 6, 1974. The second was the Alberta Oil Sands Technology and Research Authority (AOSTRA), which was established by the Government of Alberta on June 14, 1974, when Premier Peter Lougheed announced a \$100 million grant from



provincial public funds for project *Energy Bricks* through made available through the Dept. of Mines & Minerals. The act which established AOSTRA as a Crown corporation, set the terms and conditions under which these funds would be made available. Starting in 1977 AOSTRA was supported through the Alberta Heritage Savings Trust Fund after the Fund had been officially established by the Legislature on May 19, 1976. Although AOSTRA's activities were initially limited to oil sands, the act was amended on June 25, 1975 and then on Nov. 16, 1979 to broaden its mandate so as to include heavy crude oil and the enhanced recovery of conventional crude oil respectively. The Authority became operational in late 1974 and had one of its first 7 members, Dr. M.A. Cressy serve as interim Chairman until 1977. Dr. W. Bowman was appointed Executive Chairman effective July 29, 1978. AOSTRA's significant influence on the Department's research activities began in 1976, and continued through the 1980s.

...the recovery of Alberta hydrocarbon resources. Details of the establishment and initial operation of CMG were obtained by K. Aziz in company documents dated Dec. 3, 1988.



8.1

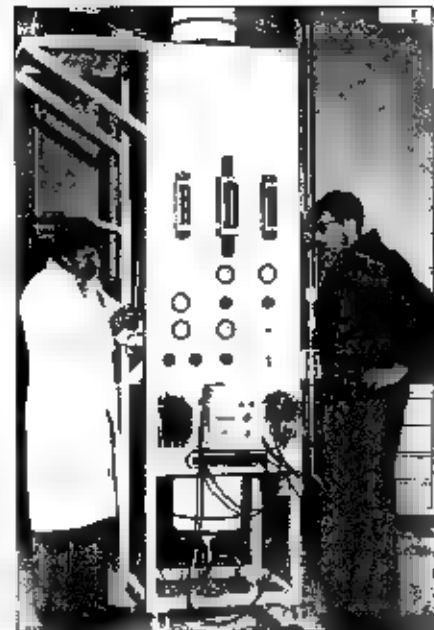
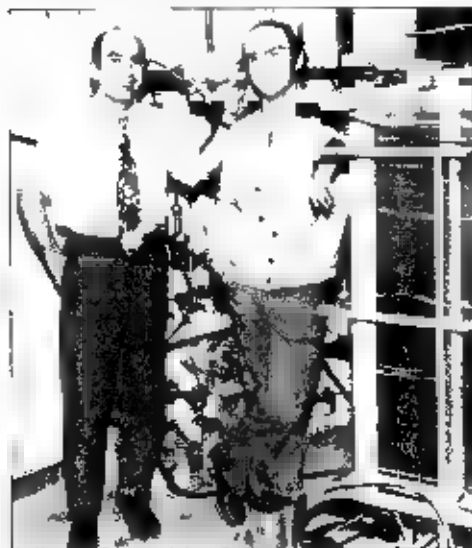
The staffing problems experienced over a result of the buoyant economy were partly offset by the fact that throughout the 1970's the Department was able to rely for teaching manpower not only on its graduate students but also on visiting graduate research assistants, PDFs and part time sessional instructors. Thus for example during 1972-73 Drs J.M. Paisbeck (see Plate 3.39) and J.R. Flores, PDF and Research Associate with Profs. Mohtad and Aziz respectively contributed directly or indirectly in achieving a very high level of performance. In 1973-74 Dr R. Sengupta, Assistant Professor, Dr A.K. Chatterjee, Professor, Dr S. Chakraverty, Professor, Mr R. Chatterjee, Professor, Dr P.A. Wasth, Professor, Dr A. Islam, Mr W. Moore were also contributing to the department.

Fellowship Association Dr. Robert
and her husband moved to the United States
it research methods in psychology. He
was appointed Assistant Professor of Psychology
terms of the 1976-77 academic year
and remained in the Department until
March 1979. Dr. Robert Braaten became
associate in Medicine at the University
from Oct. 75 becoming a full-time
Sessional instructor in Sept. 1976 and
served in that capacity for 5 years.

Amongst staff highlights we note the United Nations' involvement and support in the OWHC's efforts to protect children from sexual abuse and exploitation. Resolutions adopted by the Trusteeship Council, the General Assembly and the Security Council have provided a legal basis for her involvement with UN agencies as ACSTA and as a member of the Commission on Human Rights.

Dr. Aziz was appointed by the Senate of the University of Malaya in 1970 to the post of Associate Professor. He was relieved of most of his teaching commitments and the University was able to appoint Dr. Martin B. Smith as available and could be appointed Sessional Instructor of Engineering in 1977 (see p. 343). Other highlights include the Student's Union Master of Science Award for 1976 to Dr. R. M. M. Dr. Khalid Aziz's Killam Resident Fellowship for the Winter 77 term. Most importantly to Khalid and the Department was his appointment as the general Manager and Director of the Centre for Materials Science. CMG efforts were very significant (see Plate 3.1). Based on the agreement between the University and CMG, Dr. Aziz continued as Professor of Engineering and

Eric Tollefson was now faced with filling 2 positions for 2 of his senior staff in addition to trying to fill 2 existing vacancies. He appointed Martin B. as Asst. Prof. for 3 years, starting Sept. 1, 1977. He also hired Mr. Louis Mattar (see Plate 33.3) a 1973 MSc grad and from the Directorate as Asst. Prof. effective Aug. 1, 1977. He was successful in getting Dr. JAG A. B. (see Plate 33.4) starting Sept. 1, 1977 (see Plate 33.5) in addition to the 2 new hires. He was successful in getting Dr. R. G. (see Plate 33.6) to start in 1978.

[illegible]
$$J_1 = \frac{1}{2} \int_{\mathbb{R}^2} |\nabla u|^2 dx, \quad J_2 = \frac{1}{2} \int_{\mathbb{R}^2} |\nabla v|^2 dx, \quad J_3 = \frac{1}{2} \int_{\mathbb{R}^2} |\nabla w|^2 dx,$$

year class in the Fall '77 term, he obtained the services of Dr. V. Ramesh and Professor S. S. Saha as tutor or alternative. On 1/1/1977, with no one else available, he left for 1942 (see Plate 42). Unfortunately, in the third semester, he was not able to fill the vacancies nor as replacement for Doug Bennon. Consequently, additional Sessional staff was hired in the Fall of 1978, including Drs. A. Settari and A. Singha, the former still active in the Department after 4 years (see Plate 43) while he later served as Part-time Sessional instructor till Dec. 3, 1980. It was also on Sept. 1, 1978, with Dr. E. Stan Hall joined Eric Tolmetsen's Group as Research Associate (see Plate 44). Joining Part-time Sessional instructor during the 1980 as required and staying with the Department till June 30, 1990.

Following a suitable Departmental Secretary after the departure of Mrs Jean Donahue on June 30, 1978 took a few months. Mrs Annet Taylor was appointed on July 4, 1978 after 3 months was succeeded by Mrs Judy Porter effective Oct 16, 1978 who served as Departmental Secretary until Dec 4, 1981.

Staffing is in this category primarily by
 American firms; 2 autonomy control

ued to occupy a major portion of Eric Tollefson's time during the last 2 1/2 years of his tenure as Head. A number of the technical support staff resigned in 1979-80, including such oldtimers as Rudy Bariert, Ron Marshall and Ron Turner, as well as Jim Senger, Barbara Gibson and Patricia Towle, the latter of whom was rehired on trust funds. Also, in 1979 the Head was faced not only with 2 continuing academic vacancies but with finding replacements for 4 more of his staff who were on partial relief time. Gary Gregory was allowed to spend 3/4 time for a year, starting on May 1, 1979, on a study of gas liquid flow in large diameter pipelines, funded by the American Gas Association (AGA). Jaroslav Stanislav was seconded to Kaiser Oil Ltd. on an 80% basis for a year effective Sept. 1, 1979, to gain practical experience in enhanced oil recovery. Partial teaching relief was



Plate 3.4 Dr D.W. Benson, the first AOSTRA Professor at The U. of C. (Jan. 1, 1977 - June 30, 1982).

also granted to Gordon Moore and John Donnelly to enable them to spend more time on their in-situ combustion research and apply it to British Petroleum's Cold Lake field. One of BP's research engineers from Sunbury, Dr. M. Hadjilof, joined their group on Sept. 1, 1979, for a year and partially compensated for their relief time by serving as part-time Sessional Instructor during his stay in the Department. Additional help was obtained by hiring Mr. M. Gupta, a SAT Instructor and Mr. J. Richardson from Esso Resources Ltd. They offered the new course ENCH 5.33 *Petroleum Production Engineering*, which was introduced in the Fall '79 session as part of the programme changes resulting from the faculty-wide curriculum review initiated in 1977. They repeated the course in the Fall sessions of 1980 and 1981. The curriculum review also led to the introduction of a system of electives in the 3rd and 4th year programmes which increased the course load level for those 2 years from 20 to 23, only 1 course short of the pre-1973 level.

Other new sessional and research staff during the late 1970's included Drs. A.

Arrowsmith, J.D. Bryers and Misses B. Chan, B. Chmielewicz and Messrs. A. McDonald, J.W. Moore, M. Nicholson, D. Olesky, Schegeman, A.I. Serres, R. van der Wal and L.D. Vorndran. Also Dr. Ting-Shang Lee was hired as Assist. Prof. for a 3-year limited term effective Oct. 15, 1979 (see Plate 3.43).

who resigned before the end of his term and left on Dec. 24, 1980. Drs. Martin Bush and Richard Rowe decided to move over into Mechanical Engineering, effective July 1, 1980 and July 1, 1981 respectively and John Donnelly resigned and left on July 1, 1981. To replace these staff members, Dr. A.A. Jeje was appointed Assoc. Prof. on Sept. 1, 1980 and Drs. A.K. Mehrotra and P.M. Sigmund joined the Department as Assist. Prof. effective Jan. 1, 1981 (see Plate 3.45). In addition, Dr. A. Vysniauskas was hired as Sessional Instructor after he had completed all degree requirements during the summer of 1980. He served the Department in that capacity from Sept. 1980 till Dec. 1983. Thus, the Tollefson decade ended as it had begun, with 2 academic positions vacant.

The Department's success story in terms of obtaining external research funding during the second half of the period under review is depicted on Fig. 3.4 which shows increases of over 100% in funding levels from 1972 to 1974 and again, from 1975 to 1977. The first of these major increases was due in large part, to the 5-year \$994,000 NRC Negotiated Develop-



Plate 3.40 The technical support staff in Chemical Engineering (L to R: L. Kosman, V.L. Kraus, H. Bariert, H. Jansur, R. Turner, W. Morris, C. Jackson and R. Marshall - Oct. 1974).

ment Grant (NDG) awarded in July 1974 to the 19-member J of C interdisciplinary Sulphur Research Group, UNISUL, spearheaded by Dr. J.B. Hyne and including Drs. Havlena, Mohtadi, Rowe and Tollefson. During the 5-year period of the NDG, \$0.25 million was provided to this Chemical Engineering Group for studies related to pollution control involving sulphur dioxide, SO₂, and the desulphurization of oil sands coke. The second step-function increase in funding level resulted from the creation of AOSTRA and its programmes for university research support whereby over \$1.1 million was obtained between 1976



Plate 3.42 A leased Bell helicopter was used in obtaining test samples of polluted air from the plume emanating from the main stack of the Crossfield sour gas plant. The plume was traced with a gold tracer introduced in the form of a colloid spray in the base of the stack. The filter, with a pyramid shaped intake used in sweeping up the air samples, was mounted in a bracket attached to the front of the vehicle behind the passenger seat in which Mr. Rudy Bariert is seated. Mr. Terry Vysniauskas, a research assistant, is holding the gas analyser while the helicopter is being readied for take-off on the grounds of the gas plant. The samples were analysed using neutron activation of the gold particulate tracer. (Fall '76).



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the Group by awarding them a 5 year \$550 000 contract which was increased to \$650 000 during the term of the agreement. Further significant recognition came in the form of the first AOSTRA Professorship at The U of C, awarded to the senior member of the Group, Dr. D.W. Bennion (see Plate 3.41), an appointment which was one of the first three such distinctions in Alberta. AOSTRA's strong endorsement of the Group and the quality of its R&D work, which had been completed by the end of 1976, resulted in increased demand for studies involving the combustion tube including further contracts from BP Canada, Husky Oil and Imperial Oil as well as from new customers such as the Alberta Energy Corp., Ashland, Barnwell, Gulf Oil, Hycal, Norcen, Pacific Petroleum, PanCanadian and Petro-Canada totaling \$0.65 million over the period 1975-1981. Consequently within a few years the SCRG at The U of C became an internationally known leader in research related to tar sands, heavy oil and tertiary recovery technologies, including wet and dry in-situ combustion or *fire-flooding*, anhydrous extraction of bitumen from mined oil sands using fluidized bed direct retorting, and the study of the oxidation and reaction kinetic processes associated with fire-flooding and their mathematical modeling.

- Tar sands related research was initiated during 1972-73 by 3 staff members, namely Drs D W Bennon, J K Donnelly and R G Moore, each of them working independently on some aspect of this challenging technology. In 1973 they decided to pool their knowledge and experience and applied for and were awarded one year grants by EMR (\$12 000) and AERT (\$15 000), effective April 1, 1974 for the development of in situ recovery processes of oil from tar sands and the anhydrous recovery of bitumen from mined oil sands. With these initial funds and

- One member of the *in Situ* Combustion Group, Dr. John K. Donnelly, was also involved with Drs. J.F. Stanislav and W.Y. Svrcek in another AOSTRA funded project dealing with the measurement, correlation and prediction of the viscosity of bitumen in the presence of dissolved gases at elevated temperatures and pressures. The study was financed by a 2 year \$122 000 contract starting in Dec. 1976 and was extended for



Platz 344 The first Chemical Engineering International picnic was organized by Anil Mehrotra and Tony Mysnaszkas in 1963, in Ketter Hall. When Dr. Kandulash Choudhary was the "President" of R. G. Ghoshal was the "Vice President". Mrs. Patricia Baner, Mrs. Schegelman, M. Schegelman, and Dr. Indira R. K. Mahajan were the "Ladies". The picnic was held at the University of Illinois, Urbana, IL, on May 19, 1963. The picnic was a great success and the Chemical Engineering students of the University of Illinois, Urbana, IL, were very happy to have the picnic. The picnic was a great success and the Chemical Engineering students of the University of Illinois, Urbana, IL, were very happy to have the picnic. The picnic was a great success and the Chemical Engineering students of the University of Illinois, Urbana, IL, were very happy to have the picnic.

18 months on Nov. 1, 1979 with \$81,790 additional funding.

- After some preliminary heat loss and energy analysis studies of in-situ recovery methods during 1974-76, Dr. M.F. Mohtadi suggested *down-hole in-situ steam generation* as an alternative to fire flooding for the recovery of heavy oil and oil sands. With the help of a Research Associate (Dr. Ida Wierzbka, a PhD student (Mr. D.N. Rao, and a technician (Mr. Ron Turner), he proceeded in July 1978 to design and build an experimental facility for testing his *deep steam* technique on Athabasca tar sand. After 9 months, the *Mohtadi team* had constructed its third revised and improved model of a steam generating device (see Plate 3.47). By the time Ida Wierzbka's one year leave from the Polish Institute of Aviation Research in Warsaw was drawing to a close on July 11, 1979, several applications had been prepared and submitted for major funding. One of these submissions resulted in a 3 year \$0.25 million NSERC Strategic Grant effective Nov. 1, 1979. Additional support came in the form of a \$25,000 annual cost sharing agreement with Abacus Engineering Ltd. for 1980-82 as well as a \$63,000 AOSTRA contract in 1981. The size of the research team also increased with Dr. R.K. Kumar replacing Ida Wierzbka and 2 new graduate students, Messrs T.G. Kumari and S. Sarkar as well

as a Research Assistant, Mr. D. Naugher joining the Mohtadi Group in 1980. Mr. Rao continued to concentrate on the development of a vortex flow heat transfer system involving direct contact of the hot and cold fluid streams, while the rest of the team carried out theoretical and experimental studies on this novel recovery technique including its thermodynamic performance under high pressures. The cooperation with Abacus (renamed Abacus Energy Resources Ltd. after 1980) provided direct industrial input to the project.

- Dr. Khalid Aziz was involved in numerical simulation of environmental and petroleum engineering problems from the day of his arrival in 1965, including modelling of petroleum reservoirs, natural convection in porous media, atmospheric pollution and the flow of fluid gas mixtures in pipelines. His early studies on computer simulation of atmospheric pollution from industrial sources was supported by the Alberta Dept. of Public Health and CNGPA and involved Mr. Don G. Conley as Research Assistant. A joint application with John Donnelly resulted in \$30,000 funding from AERT (April 1972 - Aug. 1975), for the development of computer models for the prediction of pollutant dispersion in the atmosphere and the control of industrial pollution. The U.S. National Centre for Atmospheric Research also contributed \$20,000 to this study. In some of this work Richard Rowe was also involved.

Khalid Aziz's initial studies on modelling petroleum reservoirs was given strong endorsement and impetus with grants from EMR totalling \$65,000 between Apr. 1972 and Sept. 1977, allowing the development of sophisticated computer models of petroleum reservoirs and oil sands deposits and the simulation of in-situ recovery techniques of heavy oil from tar sands and enhanced recovery methods for oil from conventional reservoirs. This work culminated in the establishment of



A.A. Jeje



A.K. Mehrotra



P.M. Sigmund

Plate 3.45 The laboratory academic staff appointees during the Tollefson decade, 1980-81.

the Computer Modelling Group in 1977.

- Computer modelling was also used in simulating multi-phase flow in pipelines. A major project in this area was the study of boiling in the AECU CANDU atomic reactors carried out by two members of the Department's *Multiphase Flow Research Group, MFRG*, Drs. K. Aziz and G.A. Gregory between Aug. 1976 and March 1982 (see Plate 3.48). The work, which dealt with the boiling two-phase flow in a horizontal annulus and the flow patterns around a single rod or cluster of rods pertaining to such reactors, was funded through contracts totalling \$0.25 million.
- The flow of complex mixtures in pipes has been an active area of research and continuing education in the Department since 1964, forming the subject of a monograph published in 1972 by Drs. Govier and Aziz (see Table 3.3). From 1974-1982, members of the MFRG including K. Aziz, M. Fogaras, G.W. Govier, G.A. Gregory and J.F. Stanislaw offered annual 3-5 day Continuing Education on short courses on *Flow of Gas-Liquid Mixtures in Pipes*. The main lecturers in these courses were Khalid Aziz and Garry Gregory, whose expertise was also recognized by invitations to offer such courses abroad. Thus, for example, Dr. Aziz was asked to present a short course on *Slurry Pipelining* at the Colorado School of Mines, May 13-14, 1974, in connection with the Centennial Year Celebrations. Garry Gregory was invited to offer 3-5 day short courses on *Multiphase Flow in Pipelines* at Heriot Watt University, Edinburgh, May 1976 and Sept. 1977; at Strathclyde University, Glasgow, 1981; in Adelaide, Oct. 1981 and in Ottawa, July 1981. A highlight of his pre-

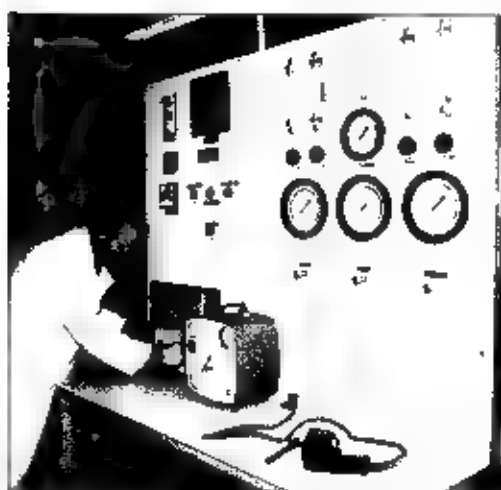


Plate 3.46 Mr. Jim Senger is working the instrument panel for the isothermal low temperature oxidation apparatus located in the Sub-Basement of the Energy Transfer Laboratory, 1978-79.

sentations was the 1/2 hour 16 mm colour film entitled *Flow Patterns in Gas Liquid Pipelines*, produced by him as Director of the MFRG in 1979-80 and also used by him in lectures at Kuala Lumpur, London, Houston, Dallas and Banff. Dr Gregory's research stature was also acknowledged through major external funding, including contracts from Mobil Research and Development Corp. Dallas (1978-80) and from the American Gas Assoc. the latter for the development of a multi-phase pipeline field data bank, \$0.232 million Jan 1980-June 1982.

- Dr P.R. Bishnoi undertook a study on the environmental impacts of hydrocarbon hydrate formation due to an oil/gas well blow out in the Arctic Ocean after he had initiated research with a Research Associate, Dr B.B. Maini, on the reaction kinetics of natural gas hydrate formation (1976-77). The sea-floor project was funded by contracts with the Dept. of Supplies and Services, DSS, over the period July 1977-March 1980 totalling \$141,535. Financing for further investigations on the kinetics of natural gas hydrate formation was provided in 1980 by the J.S. Gas Research Institute and by DSS.
- Environmental Engineering was one of the strongest research areas during the Department's nine years of operation with emphasis on various pollution control problems. A major study on the fate of sulphur dioxide, SO₂, in the atmosphere, initiated by

Dr M.F. Mohadjeri in 1972-73 with funding from CNGPA and an NRC/NDG \$28,000 (July 73-June 74) was continued as *Project No. 4* of the UNISUL programme by Drs M.F. Mohadjeri, R.D. Rowe and J.J. Havlena with Rowe as the project leader and Drs S.F. Benjamin and D. Ekall as Research Associates and Mr. A. Vysniauskas as Research Assistant. Funding from the UNISUL NRC/NDG amounted to \$129,500 over the period April 1974-Dec 1976 (see Plate 3.42). Drs G.W. Hodgson from the Environmental Sciences Centre in Nananaskas and H.R. Krause from Chemistry were also members of this UNISUL Group.

- A study on atmospheric dispersion of stack plumes in complex terrain was initiated by Dr R.D. Rowe in 1972 with the cooperation of Dr J.J. Havlena who had been using visible and infrared nephelometry, laser long range infrared spectrophotometry and time-lapse photogrammetric techniques for the measurement of plume kinetics at industrial emission sources since 1969. The study was in low gear until Feb 1977 when a 2 year \$85,000 cooperative grant from AERT and Shell Canada Resources Ltd. was awarded to the two researchers and their Associate

Dr S.F. Benjamin for the completion of their 5 year study concerned with the dispersion of pollutants near the Capthorne Ridge, approximately 1 km east of Sher's Jumping Pound sour gas processing plant. The project was aimed at verifying Richard Rowe's new two-layer model for the prediction of pollutant concentrations and dispersions. Results from the study led to guidelines for the determination of ground level pollution concen-



Plate 3.47 Dr. M.F. Mohadjeri (R) with his Research Associate Dr. Jozsef Wierusz and Mr. Ron Turner standing next to the flow-die stack generator in the Energy Transfer Laboratory used in the study of a hazardous very low-boiling oils. March 1979.

trations which are more realistic and lower than those based on earlier specifications with associated economies in stack designs.

- Dr M.F. Mohadjeri began his environmental engineering studies in 1967 including clean-up of waste waters, mapping of polluted air and polluted rivers, induced surface turbulence to improve water quality in lakes and reservoirs, removal of SO₂ from stack gases and stack sizing formulae to allow conversion of SO₂ to sulphur and the prediction of SO₂ concentrations at ground level. NRC grants and funds from the CNGPA and EMR were used to finance these studies in some of which Drs J.J. Havlena, J.F. Stanislaw, R.D. Rowe and/or graduate students and research assistants were also involved. In 1972-73 with the assistance of Dr J.M. Raisbeck and a \$14,500 grant from AERT, he initiated a study on the environmental problems created by oil spills on land (see Plate 3.39). The project was continued for over 3 years with Dr J.J. Duffy succeeding M. Raisbeck in Sept 1974 and with total funding from AERT of \$45,000 over the period April 73-May 76.
- As a founding member of the Department's Environmental Engineering Group, Dr E.L. Torielsen was a pioneer and ardent crusader for protection of the environment and pollution control. He was involved in short courses on *Air and Water Pollution*, gave lectures at high schools, professional and community club meetings, and championed his cause through radio and

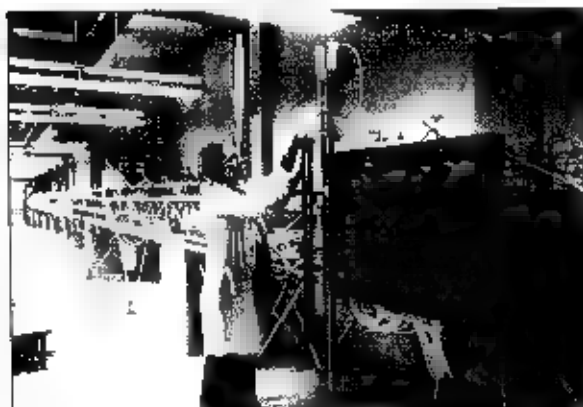


Plate 3.48 Mr. Roy Marsall, technician, is working on the multiphase flow pipeline loop in the sub-Basement of the Energy Transfer Laboratory. The loop was fabricated and operated during the 1970s and was used in the AERT/CANADONCA reactor study in 1978.

TV broadcasts. He was a member of local, provincial and national professional committees concerned with pollution and the environment and served on public advisory committees at the municipal and provincial levels. In his early research at The U of C he concentrated on removal of organic materials, phosphates and metals from waste waters, on the effects of toxic materials on the rate of biochemical oxidation of waste materials, on the catalytic oxidation of organic contaminants in aqueous media, on the reduction of nitrogen oxides in stack gases, and on purification of potable water supplies. One of his projects funded by the Alberta Dept. of the Environment (\$15,000; 1974-75) dealt with color removal from the drinking water supplies of 2 Alberta towns, High Prairie and Thorhild. A second major study was concerned with the removal of hydrocarbons from the waste water from oil sand recovery operations, supported by AERT in the amount of \$71,270 over the 4 year period June '74-Sept '78.

His work on producing activated carbon from charcoal was first supported by Lusscar Coal Ltd. (1971-73), and was expanded into a project on process development funded by a \$40,200 grant from ERPF (1980-81) (see Plate 3.50). His membership in UNISUL related to a project on the desulfurization of tar sands coke for which he obtained \$88,900 during the 5 year period of the NDG and for which he secured further funding from AOS-

TRA after 1979 (\$142,430-Dec '79-Sept '82). From Sept. 1978 he had Dr. E.S. Hal as a Research Associate which proved to be a most productive collaboration during the following 12 years (see Plate 3.43).

- Biochemical research came to the Department through a 3 year NSERC Strategic Grant (\$484,000; Nov '80-May '83) awarded to a group of 4 academics and spearheaded by Dr. L.A. Behie for research on the production of pharmaceuticals in a liquid fluidized bed bioreactor. The project turned out to be Leo Behie's stepping stone into biotechnology and the eventual establishment of the Pharmaceutical Production Research Facility (PPRF). His 3 colleagues involved in the project were Drs. G.M. Gächter and B.H. Lesser from Bio-Chemistry and K.S. Tan from Physics.
- With a PhD student D. Berk, Dr. L.A. Behie was able to establish the viability of the catalytic decomposition of hydrogen sulfide into hydrogen and sulfur using a gas fluidized bed reactor. The process was patented after a Calgary firm built a \$500,000 skid mounted pilot plant to demonstrate it. Canadian Patent No. 1,134,596 was issued on Nov. 2, 1982 to L.A. Behie, D. Berk, P.R. Bishnoi and W.J. Svrcek.

As we have seen from the narrative in this Section, the energy crisis and the resulting economic boom in Alberta's oil and gas industry had a profound influence on the Department. It changed research directions for many of the staff and brought about new areas of investigation tied to the development and introduction of undergraduate and graduate courses in petroleum engineering and a revision of the Chemical Engineering curriculum with an emphasis



Plate 3.49 Dr. D.W. Bevington, R. Witzel, and his teaching staff Messrs. Leo D.L. Vonnort, K. S. Tan, and Sengei squatting, preparing the combustion tube for another burn. ca. 1974-76

has on Alberta's natural energy resources, and it brought about an increased demand for graduates with specialization in various sub-disciplines of petroleum engineering. It was therefore natural that a number of developments were suggested or revived for Chemical Engineering during the late 1970's, including proposals for: i) a name change, ii) the establishment of a Chair in Petroleum Engineering, iii) a BSc programme in Petroleum Engineering, iv) an Extension to the Chemical Engineering Wing, first proposed in 1967.

Of these departmental objectives only the first one was achieved during the Tollefson decade when, on May 15, 1980, the Board of Governors approved a name change for the Department from *Chemical Engineering* to *Chemical and Petroleum Engineering* effective immediately. Eric Tollefson also did the ground work in establishing the Chair in Petroleum Engineering, sending a proposal to the Dean and the V.P. (Academic) early in the New Year, 1980. By mid-summer the Chair had been approved by the administration. After the fund raising campaign was approved by the Board (on Sept. 17, 1981) industry's strong support of the Department's activities was, once again, displayed most impressively. By March 1982 the campaign was completed with funds donated for the establishment of the Chair substantially exceeding the targeted amount. Details of the activities relating to these 4 major departmental goals are discussed in part in the next Section, and are summarized in Appendix E.

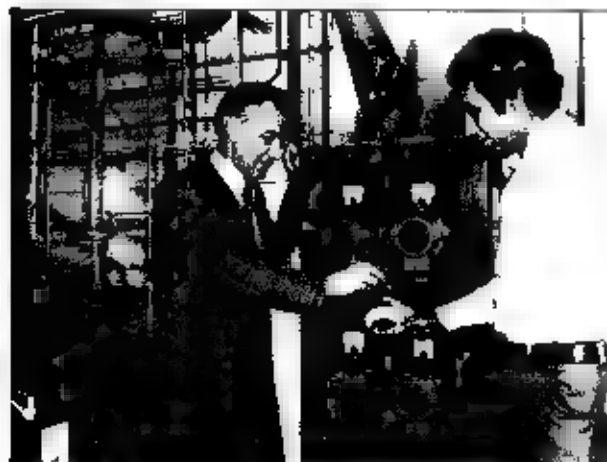


Plate 3.50 Prof. Eric L. Tollefson and his MSc student Mr. R.S. Parrish, are using the reactor system to produce activated carbon from tar. ca. 1974-75



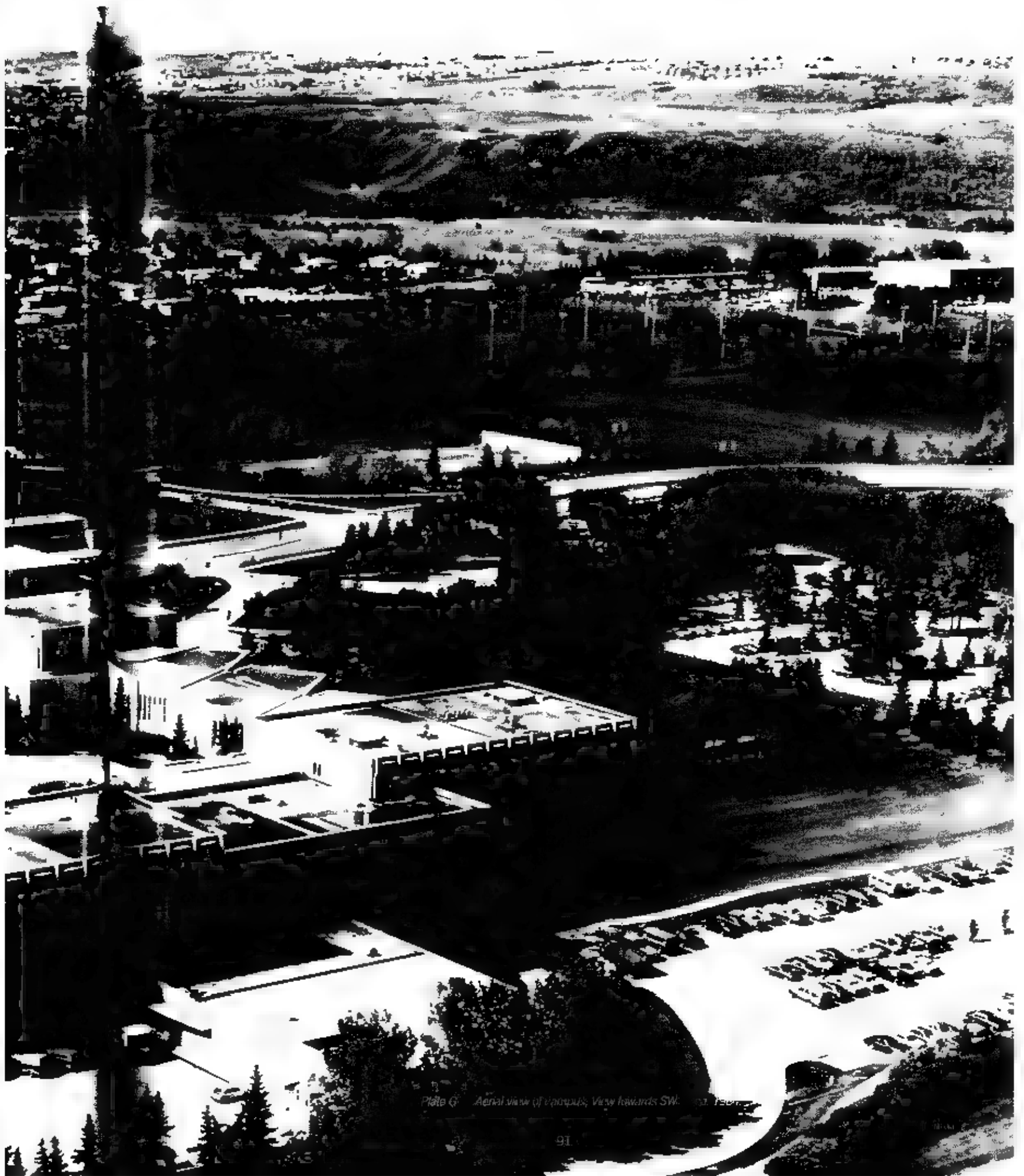


Plate G Aerial view of campus, View towards SW.

TOWARDS GOALS

When Dr. Robert A. Heidemann took office as the 4th Head of the Department of Chemical and Petroleum Engineering on July 1, 1981 (see Plate 3.51), there were a number of factors which facilitated his task in working towards or achieving the Department's primary goals, defined in the previous Section. One of these factors was Alberta's economy which was still riding on a crest as it had been for most of the preceding decade. The accompanying general prosperity and record levels of employment, growth and double digit inflation affected all segments of society including students and staff at universities. Thus, for example, engineering graduates were a much sought after commodity who enjoyed the advantage of being able to choose from a number of firm job offers months before graduation. The 1981 graduates from Chemical and Petroleum Engineering comprised 2 PhD, 6 MSc, 2 Dip and 60 BSc degree recipients were no exception to this kind of good treatment even though the size of the latter group and the number of females in the class established new departmental records at the time (see Figs. 3.5 and 3.3). The academic staff at The U of C was compensated in part for the loss in purchasing power of their salaries due to the continuing high inflation



R. A. Heidemann, N. Wilson, A. Badakhsha, M. A. Jassanglu, N. Mysad

Plate 3.5 The fourth head of the department and his first four academic appointees. (R. A. Heidemann)

through three consecutive salary scale adjustments (1980-1982). These salary increments helped to overcome a serious faculty morale problem and contributed to the efforts directed at stemming the exodus of engineering academic and support staff between 1978 and 1982.

The heated up condition of the oil patch economy undoubtedly also had a beneficial influence on the fund raising drive for the Chair in Petroleum Engineering. The campaign was initiated in September 1981 and was concluded by March 1982 with total contributions exceeding the targeted goal of \$600,000 by more than \$230,000 (see Plate 3.52 and Appendix E for details).

The upbeat atmosphere in the Faculty and the Department was also

enhanced by a number of internal developments and events. As of January 1981, the New Civil Engineering Building had been under construction. This development was taken as an indication for the cancellation of or at least a significant thaw in the government's freeze on new capital construction which had been in effect since 1975. For Chemical and Petroleum Engineering, this project meant renewed hope and a real possibility for construction on the Extension to D Block to proceed at an early date. That the Dean, Dr. T. H. Barton, was of the mind concerning the expansion possibilities is apparent from the EFC minutes of Sept. 17, 1981 according to which, after commenting on the construction progress on the New Civil Engineering Wing, Dr. Barton is reported to have said that there is no better time than the present to plan expansion.

The Dean's opinion was reinforced at a meeting on Friday, Dec. 4, 1981 held in Edmonton and called at the initiative of APEGGA by Dr. Henry Kolesar, Deputy Minister of DAEM, for the purpose of discussing the demand and supply of engineers over the next decade. The meeting at which the Engineering Deans and Academic Vice-Presidents from the U of A and The U of C, APEGGA officials and Dr. Kolesar's Assistants were present, agreed that the demand for engineers would remain high for the next 10 years. The Deputy Minister also indicated that the Government and DAEM were well disposed towards an expansion of the faculties at Calgary and

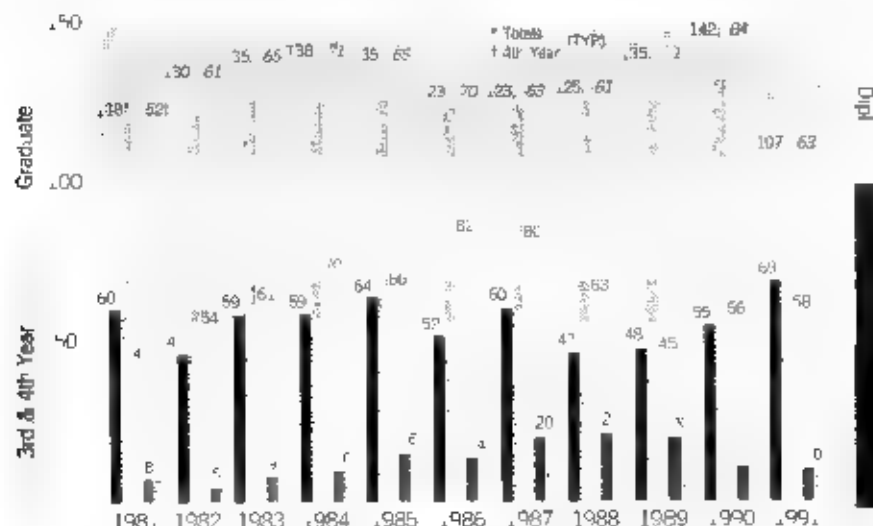


Fig. 3.5 Graduates from the Department of Chemical and Petroleum Engineering, 1981-1991.

Chemical and Petroleum Engineering 1981-1991

Edmonton (see EFC Minute #81-4-3, Dec. 17, 1981).

As a result of this meeting and at the request of the V.P. (Academic) Dr. P.J. Krueger, Tom Barton submitted an 8 page draft of the Faculty's *Long term Academic and Space Planning* document, dated Dec. 11, 1981. An expanded version of this plan was presented to and discussed at EFC on Jan. 21, 1982. It called for an increase in undergraduate enrolment from the current 1,231 to 2,000 students by 1990 with a 50% increase in staff and physical facilities at a capital cost of \$800 million and an increase in the Faculty's annual operating budget of \$100 million. It was this document which served as the basis for discussion between Dr. Fred Ogilvie from DAEM and the Dean and Department Heads at a meeting requested by the Ministry and held in our Faculty on Wednesday, Jan. 27, 1982. According to Bob Hedemann's report to his colleagues at the Departmental Council meeting on Feb. 15, 1982, the DAEM officials expressed concern about the high cost of the proposed expansion and expected the petroleum engineering programme and the extension to the Chemical Engineering Wing to be the first additions to our Faculty.

Based on the revised plan for *Expansion of the Faculty of Engineering* dated Jan. 31, 1982, GFC approved

the expansion to 2,000 students by 1990 for academic program and space planning purposes at its meeting on March 25, 1982.

With so much optimism about the possibilities for expansion, it was natural for the Department and its new Head to be anxious to see their proposal for a BSc programme in petroleum engineering finalized, approved and transmitted to DAEM at an early date. The Letter of Intent for such a programme submitted in April, 1981, had been approved within 3 months. However, the preparation, finalization and institutional approval of the full programme proposal, which included the construction of the Chemical Engineering Extension as a condition to the implementation of the programme, took almost 2 years. It was delayed by several factors, including the sudden downturn in the economy. Soon after the fund-raising campaign for the Chair in Petroleum Engineering was successfully completed in February/March 1982, the oil patch boom turned into deep recession within a few months. Under the impact of the National Energy Policy and the initial effects of world



Plate 3.52 Mr. S. Keith McWalter, President of Gulf Canada Resources Ltd. and Mr. W. Robert Porteous, President of TTI Geotechnical Resources Ltd., Chairman and Member of the Petroleum Engineering Chair Fund Raising Committee, respectively, are shown after the presentation of the first two major donations to Dr. Norman Wagner, President of The U of C. Mr. McWalter is using a model similar to the prototype to be used in the Beaufort Sea to explain the workings of a drilling platform. A \$30,000 cheque came from the Petroleum Society of the Canadian Institute of Mining and Metallurgy (PSCIM) while a second \$40,000 cheque was issued by the local section of the Society, the past chairman of which was Bob Porteous. Monday, Sept. 2, 1981.

price instabilities, the latter leading to the oil-price-crash of the 1980's. Almost overnight, job offers were being withdrawn, plans for expansion were curtailed or cancelled and massive layoffs replaced aggressive hiring policies. Suddenly, programmes and activities related to petroleum engineering education and research were no longer the high priority items they had been during the preceding years. Therefore, the submission, which was transmitted to the Ministry soon after its approval by the Board on May 19, 1983, was and still is awaiting funding approval. Details of the Department's activities directed towards achieving its primary goals, including its efforts related to this programme proposal, to the subsequent fund-raising campaign for the D Block Extension and to other Petroleum Engineering initiatives are briefly summarized in Appendix H.

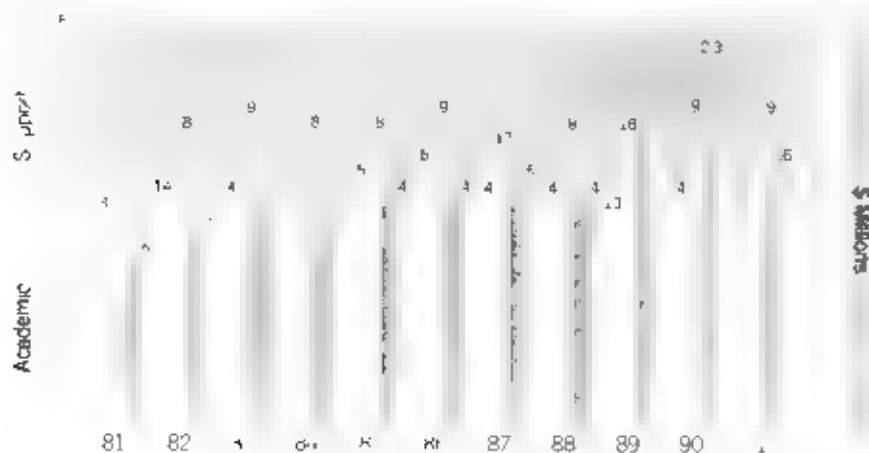


Fig. 3.6 Full-time Academic and Support Staff and Annual External Research Funding in Chemical and Petroleum Engineering 1981-1991.

In the summer of 1981, however, the new Head of the order of business was running the starved department. The Department's earnings were low. He inherited 2 academic vacancies in addition. Khalid Aziz continued on a part-time basis as Director of the Computer Modeling Group (CMG) while 80% of Doug Bennon's time was committed to research during this busy year as AOSTRA Professor. In addition to 3 staff members being on sabbatical, Gordon Moore was given half-time leave to enable him to concentrate on his in situ combustion research work.

In contrast to this manpower picture enrolment statistics for the Fall 81 session projected a very positive future. The Head was informed during the summer that in September the Department would take its largest enrolment to date, numbering 66 students. Graduate registration was also rebounding with 21 MEng candidates enrolled thereby establishing a new record high for this group. A similar trend for the following years. The part-time engineering offerings continued to be successful as ever with the 3 undergraduate and 5 graduate part courses attracting 545 enrollees during 1981-82. Many of the regular classes were downed prior to start, registered as in-classified students.

To handle this increase teaching load, Bob Hejranian was asked to find extra help and this was done by bringing on staff consisting of Drs. V. Kamlesh, A. Seltzer, A.

W. J. Usk and A. H. Yoon. Rejoining Messrs. M. S. Pita and J. Kharabian. He appointed two of the Department's senior graduate students, Messrs. K. O. Adegbesan (see Plate 345) and D. Bek and hired Drs. D. B. E. H. and L. N. Novosad and J. W. and M. A. Matta as Sessional instructors for the Fall and/or Winter session. Dr. Novosad was to continue his association with the Department for the remainder of the period under review (see Plate 351).

Staff changes during the new year included Bob Hejranian's term of office including the resignation of Mrs. Judy Porter, Departmental Secretary since 1978, who left on Dec. 4, 1981 and was replaced by Norma Wilson 10 days later. Mrs. Wilson was an Administrative Assistant to the Head in 1994 (see Plates 341 and 356).

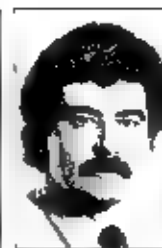
Highlighting the 1981-82 academic year included the establishment of the C. A. H. Distinguished Visiting Chair. The inaugural lecturer was Prof. Octave Levenspiel of Oregon State University in May 1982. The first year he had had his new wife, known and was being used in carrying out a lot of work in the field and overseas, anything goes, but with a lot of experience and Peruvian duty was visited in Apr. 1982 by the Peruvian ambassador. Later in the spring Dr. Gordon Moore visited Peru as a member of an Alberta Government Trade Mission.

The Department's social highlights included the Faculty Sports Day (see Plate 364) instituted in 1982 and the annual football game played after 15 years on September 19, 1982. The Rafter 6 Ranch (see Plate 344) the picnic was moved to the Tree Farm with the first picnic at this new location held on Sep. 6, 1982 (see Plate 364).

During the successful



E. J. Gernert



N. E. Kharabian



M. A. Hastaglu

Photo 344: Dr. E. J. Gernert, AOSTRA Professor in Petroleum Engineering, 1981-82.

ful conclusion of the fund raising campaign for the Chair in Petroleum Engineering early in 1982 the Department learned of the appointment of Eric Torsetson as the second AOSTRA Professor in Engineering effective July 1, 1982, a distinction which he held for 5 years (see Plate 354).

As one notes from Fig. 3.6, the academic and support staff complement of the Department stayed fairly constant throughout the 1980's. Bob Hejranian's first time academic appointees were Drs. A. Badakhshan and M. A. Hastaglu hired as Professor and Assoc. Prof. effective Aug. 27 and July 1, 1982 respectively (see Plate 351). Dr. Khalid Aziz, one of the Department's first time academic resignees after 17 years and left on Aug. 31, 1982.



Photo 344: Dr. E. J. Gernert, AOSTRA Professor in Petroleum Engineering, 1981-82.

With the recession deepening during the summer and fall of 1982, finding sessions and permanent academic staff became somewhat easier.

Thus, Drs. E. Czaplowski and S. Saven were hired as Sessional instructors (Part time) effective Jan. 1, 1983. Both of them continued to be associated with the Department to the rest of the decade. Also by the Spring of 1983 Dr. Roger M. Butler had been selected for the Petroleum Engineering Chair (see Plate 357). He had offered a graduate course during the 1982-83 academic year as Sessional Instructor. The Aziz vacancy was filled by hiring Dr. N. E. Kharabian as Assoc. Prof. effective Oct. 5, 1983 (see Plate 353). During the Fall 83 session another long time staff member

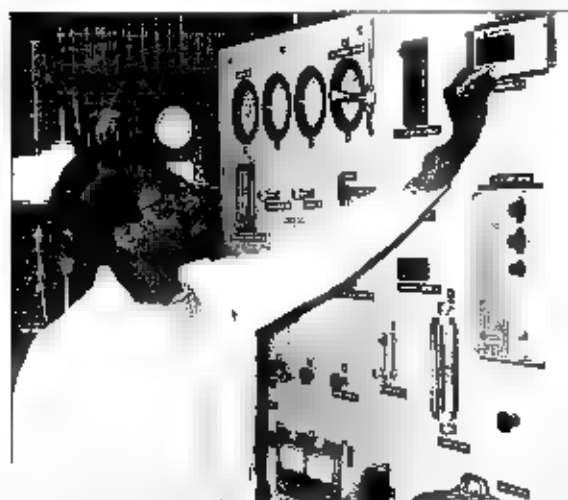


Photo 345: Dr. K. O. Adegbesan, AOSTRA Professor in Petroleum Engineering, 1981-82.

Dr Garry Gregory decided to go into industry, resigned and left on Dec 31 1983.

The last academic to resign during the 1980's was Dr Norton McDuffie who left on June 30, 1984 after 15 years of service. Dr Andy H Youngers' long-standing association with the Department was recognized by appointing him Adjunct Professor effective Sept 1, 1985, an appointment which is continuing in 1994.

The next change in permanent academic staff resulted from the early retirement of Dr D W Bennion in 1986. Doug Bennion had joined the Faculty in September 1965 as one of the two first full time academics in Chemical Engineering at Calgary. His significant contributions were acknowledged by appointing him Professor Emeritus effective Sept 1, 1986. The McDuffie/Bennion vacancies were filled, effective Sept 1, 1986, by hiring Drs Franco Berruti and Mark A Trebble as Assist Prof, the latter being a 1986 PhD graduate of the Department (see Plates 3.53 and 3.63).

On July 1, 1986 Bob Heidemann went on a 12 month sabbatical leave to the Technica University of Denmark after he had been reappointed to a second term, July 1, 1987, June 30, 1992. During his leave Dr

R G Moore was Acting Head who appointed 3 colleagues, namely Drs J K Donnelly and G A Gregory as Adjunct Professors, effective Jan 1, 1987, and Dr J Novosad as Adjunct Assoc Prof effective July 1, 1987. After returning from his leave Bob Heidemann appointed Dr A Settari as Adjunct Assoc Prof on Sept 1, 1987. All 4 continue to be associated with the Department in 1992.*

The final group of academic staff changes during the Heidemann Decade involved the retirements of Mrs M Fogaras and Prof M F Mohtad effective Sept 1, 1987. Maria Fogaras had served the Faculty and the Department for 23 years. In recognition of her significant contributions she was appointed Sr Instructor Emeritus. Matt Mohtad took early retirement after 20 years in the Department, and went to South Africa. After his return in 1989 he resumed activities in the Department and the Faculty on a part time basis. His important contributions to the institution were acknowledged by appointing him Professor Emeritus effective May 1, 1990. A third *old timer*, Dr J J Havlena, also took early retirement on Jan 1, 1989, and was awarded Sr Instructor Emeritus status, effective May 1, 1989, for his longstanding service and contributions to the Department and the Faculty.

To make up for these retirements Bob Heidemann hired Drs A Chakma and J D M Belgrave as Assist Prof, effective Sept 1, 1988 and Jan 1, 1989 respectively. With the appointment of Dr E (Ted) Rhodes as Dean of the Faculty, the Department gained an additional academic starting May 1, 1990 (see Plates 3.59 and 3.65). Roger Butler was reappointed and continued as Chairholder until June 30, 1994.

As is apparent from Fig 3.5, the 1982 downturn in the economy and the subsequent recession did not influence the Department's enrolments significantly. In fact, the num-



Plate 3.56: *Who said a secretary does all work and no one else? Not in this Department! R. Nojima, Wilson, Cindy Seibert and Sherry Flynn. Summer 1982.*

ber of applicants for entrance into the third year Chemical and Petroleum Engineering programme in the Fall of 1982 reached a new peak of 90. Also, both undergraduate and graduate student numbers continued to grow until the mid 1980's, establishing records which stood for the remainder of the decade and in some cases till now 1992. For example, the BSc graduating class size of 1985 was exceeded only in 1991 while the number of graduate degree recipients during 1987-89 established a departmental high to date. Two significant enrolment and convocation statistics, however, are not shown on Fig. 3.5, data which is presented on an extra figure (see Fig 3.7). This additional information includes the number of female 3rd and 4th year students, female BSc graduands and the number of male and female MEng registrants and degree recipients. As one notes from this figure, the female undergraduate enrolment remained relatively high throughout the decade, peaking in 1990. The number of MEng registrants continued to grow from its 1981 level, reaching a maximum only in 1987. Interestingly, the Department's first 2 female MEng graduands, Ms Y H Huang and Ms D A Sheldon, received their degrees at the 1986 Spring and Fall



Plate 3.58: *Mr Viet V But, Research Assistant, in Prof E. Tappesba's laboratory, working with the equipment used in the distillation tests in 1982/83.*



Plate 3.57: *Dr Roger M Butler, reappointed as Chair in Petroleum Engineering, 1984. He is inaugurated holder of this Chair in 1984.*

* Dr J. Novosad became seriously ill and passed away in 1991.

graduation exercises, respectively. It was also at the June '86 convocation when the first 2 MEng degrees were awarded to Chemical and Petroleum Engineering students enrolled in a course-work only programme.

It was encouraging and gratifying for the Department that the increase in enrolment was accompanied by an improvement in quality of its student body. Evidence of this fact was, for example, the increase in the number of BSc degree recipients graduating *with distinction*, which rose from 4 in the 1982 class of 47 to 8 out of a class of 59 in 1983. In 1984 and 1985 the graduating classes numbered 59 and 64, respectively, each had 7 students finishing with distinction. This quality and performance also led to an increase in the number of award and major scholarship winners. In 1983, 2 of the 8 top students were awarded NSERC scholarships, while 3 members of each of the 1985 and 1988 graduating classes were recipients of such awards. One member of the former trio, *Mark Douglas Taylor*, was the only U of C student winning the prestigious 1967 Award. At the June '84 convocation, a member of the Department's graduating class, *Andrew R. McIntosh*, was awarded the *Munei Kovitz Prize* in recognition of achieving the highest academic standing amongst all U of C undergraduate degree recipients that spring. The following year, *Judy A. Fairburn* was selected winner of both the APEGGA Gold Medal and the EIC Student of the Year Medal for 1985, an achievement duplicated in 1988 by *Cecilia W. K. Tse*. The Department Head commented

on this increase in overall student quality in his 1984 Annual Report and noted the Department's success in retaining a number of its top students for graduate work.

Student quality and performance also manifested itself in extracurricular activities. Thus, for example, members of the 1988 graduating class played a key role in the organization of the Northwest Regional Joint Student Conference of the Can. Soc. for Chemical Engineering (CSCHE) and the American Institute of Chemical Engineers (AIChE), held in Banff, April 30 - May 2, 1988. The conference, at which students from 3 Canadian and 4 U.S. Colleges were participating, was chaired by a member of that class, *Nina V. Novak*. *David C. Godard*, another outstanding member of that class, won 1st prize in the design competition with his group members, *Roderick P. Batycky*, *Harvey D. Oetke* and *Cecilia W. K. Tse*. *Roderick* and his younger brother, *Richard P. Batycky*, BSc '90, who enrolled in graduate programmes at Stanford and at MIT, respectively, are the sons of *Jim Batycky*, a former staff member and one of the Department's first PhD students (see Plate 3.33). In reviewing the list of graduands from our Faculty, one encounters further examples of children following in their parent's footsteps. One of the more striking cases is that of the *Wichert family* where not only father and the 3 sons graduated from the Department but



J. D. M. Belgrave

A. Chakma

E. Rhodes

Plate 3.59 Further academic staff appointees, 1988-90

where the mother is also a U of C grad (and (see Plate 3.61).

Outstanding performance by groups of students often goes hand in hand with inspired teaching. The high calibre of the Department's instructional activity during the decade under review is brought into focus by 3 awards from The U of C Students. In 1984 a *Superior Teacher Award* to Dr. N. E. Kegerakis, in 1986 a *Teaching Excellence Award* to Drs. A. K. Mehrotra and R. G. Moore, in 1988 and 1990, respectively. Other staff highlights include the CSCHE's *R. S. Lane Memorial Lecture Award* for 1987 to Dr. Roger M. Butler. After delivering his invited lecture at the Canadian Engineering Centennial Conference in Montreal, Dr. Butler was presented with the prize and scroll at the Society's Awards Luncheon on Wednesday, May 20, 1987. He was also named *Distinguished Lecturer* of the U.S. Society of Petroleum Engineers for the period Sept. '87-July '88 during which he presented lectures at 23 local Sections of SPE in North America, from Alaska to Texas, and in the Far East, including Australia and Japan. Dr. Eric L. Tollefson was selected as recipient

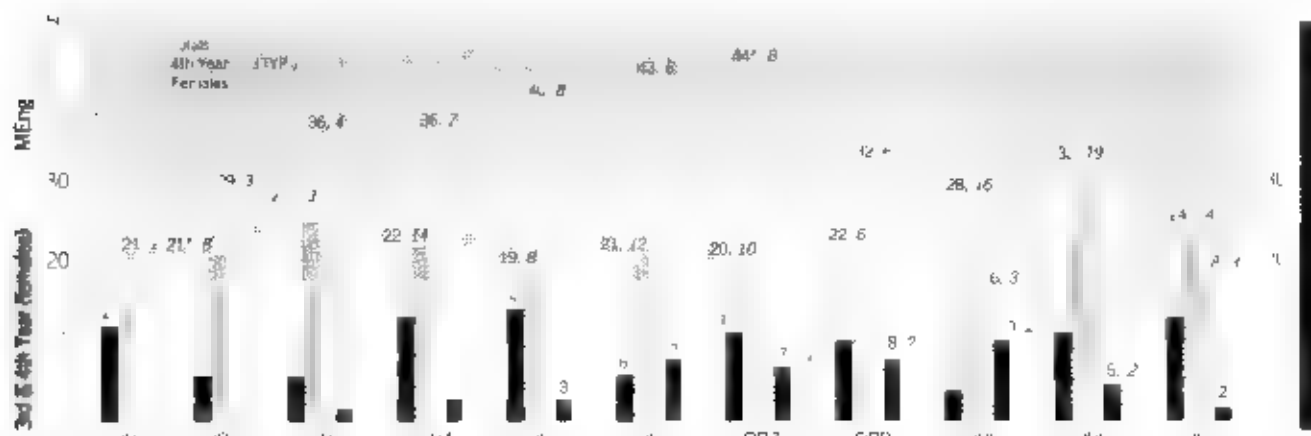


Fig. 3.7 MEng and Female Undergraduate Enrollment and Graduation Statistics for Chemical and Petroleum Engineering, 1981-1991

of the 1987 CSChE Award in Industrial Practice, sponsored by Esso Petroleum Canada Ltd. He was also honored at the Society's Awards Luncheon on May 20, 1987. This distinction came shortly after a best paper award for work published during 1986 in the *Can. J. of Chemical Engineering* (see Plate 56).

The staff was particularly active in organizing national and international conferences during the 1980's. For example, Dr. R. A. Heidemann was a member of the Organizing Committee for the 4th Int. Conf. on Fluid Properties and Phase Equilibria for Chemical Process Design, held in Helsingør, Denmark, May 11-16, 1986, and was Chairman of the 5th Int. Conf. in this series held at Banff Apr. 30 - May 5, 1989. Dr. R. Bishnoi was also involved in the organization of the latter. Dr. L. A. Behie was a member of the organizing committee of the 5th Int. Conf. on Fluidization, which was also held in Helsingør, May 18-23, 1986. With his colleagues Drs. F. Berruti and W. Y. Svrcek, he spearheaded the organization of the 6th Int. Fluidization Conf. at the Banff Centre, May 7-12, 1989. The 9th Int. Congress on Fluidization was held at the Convention Centre in Calgary, June 26 - July 1, 1988 with the preceding 1984 congress venue being Berlin. Dr. Eric L. Tollefson was Chairman of the Organizing Committee and member of the Executive of the Congress Committee. Drs. A. Badakhshan, F. Berruti, P. R. Bishnoi, M. A. Hasteoglu and M. F. Montan were



MSc. Candidate, M. A. Hasteoglu, working in the laboratory. He was awarded the best paper award at the 1989 Int. Fluidization Conference, Banff, Alberta, Canada.

also members of this Committee. Nine of these 3 major international conferences had previously been held in Canada. Dr. W. Y. Svrcek was active over a period of several years as Chemical Sciences Chairman in organizing very successful sessions at the Annual Computer Simulation Conference, held in St. Louis, MO, 1985; Reno, 1986; Montreal, 1987; and Calgary, 1990, for the latter of which he was also overall Programme Chairman in recognition of his contributions to the organization of these conferences and to the activities of the Society for Computer Simulation. He was awarded the Society's Certificate of Appreciation in 1985 and was a recipient of the Institute of

Chemical Sciences and Technology (CST) Service Award at their Technology Day in Toronto, Nov. 27, 1989.

Some of the above noted staff highlights are related to research activities which continued to expand during the 1980's from an already impressive 1981 level. Part of the impetus for this growth came from the record graduate enrolments (see Figs. 3.5 and 3.7) and the quality of the graduate students. Additional momentum was provided by the establishment of the Petroleum Engineering Chair in 1985, the appointment of Eric Tollefson as the Department's second AOSTRA Professor. Branching out into new areas of research also served as a significant factor in this expansion. Thus, for example, studies were initiated on biochemical and biophysical problems which led to major new research directions for some of the staff and the establishment of the PPRF at the end of the decade. The Department's growing research strength, maturity and stature also brought about an increasing number of international consultative and contract assignments. As a final indicator we note the increasing annual external research funding which grew from \$1.0 million in 1981 to a departmental and faculty record level of \$2.3 million by 1990 (see Fig. 3.6). Most of the funding during the decade came in the form of grants and contracts from organizations such as AOSTRA (\$4.7 million).



Member of the Wichert family is a graduate student in the Department of Chemical Engineering. From left to right: M. A. Hasteoglu, F. Berruti, E. Bishnoi, M. F. Montan, and Nov. 1989.

and EMR (\$1.7 million) and from the bio-chemical/pharmaceutical industry (\$1.3 million) and the oil and gas industry (\$1.7 million). Direct contract work using the combustion tube yielded an additional \$1.1 million during the 1980's from companies including BP Canada, Gulf Oil, Hudson Bay Oil & Gas, Husky, Hycal, Petro Canada and Sask. Oil. A few of the many outstanding research initiatives which contributed to and resulted from this explosive growth include the following:

- The *In Situ Combustion Research Group*. ISCRG continued to be one of the most successful groups in the Department and in the Faculty in terms of obtaining external funding (\$3.6 million during 1982-91) even after one of its founders (John Donnelly) left and its senior member (Doug Bennion) retired in 1981 and 1986, respectively. Leadership of the group was assumed by Gordon Moore who was able to find outstanding young researchers as replacements. One such addition was John Begrave who joined as a PhD student in 1982 and became a permanent member of ISCRG after graduation in 1987 (see Plate 3.65). The relevance of the group's research is underlined by the high demand from industry for contract work using the combustion tube which

continued throughout the 1980's. International recognition came in the form of invitations for consultation and participation in conferences and symposia particularly to its two senior members, Drs. D.W. Bennion and R.G. Moore. The Group's most recent international co-operative research venture is the *Hungarian Connection* initiated in 1990 and continuing in 1992 (see Plate 3.66).

- A second most successful research group is the Pharmaceutical Production Research Facility (PPRF) under the direction of Professors L.A. Behie and N.E. Kalogerakis. Established in 1989, this group had its beginnings in the early 1980's through an NSERC Strategic Grant for the production of pharmaceuticals in a liquid bed bioreactor. A contract for the development of a perfusion reactor for the large scale production of monoclonal antibodies was signed with ChemBioMed Ltd., Edmonton (\$35,800, 1982-83), work which was continued under a second NSERC Strategic Grant (\$133,000; 1983-84). By 1986, the work of the Group, which involved L.A. Behie, G.M. Gaucher, N.E. Kalogerakis and B.H. Lesser was becoming known internationally as evidenced from the invitation for Leo Behie to present a paper, co-authored by G.M. Gaucher, at the Bioverfahrenstechnik Kongress in Stuttgart, Germany, Sept. 24-26, 1986. Further industrial support (see Plate 3.67) was used for optimization and control of continuous production of antibiotics, including penicillin, for the development of an immobilized mammalian cell bioreactor producing monoclonal antibodies and for the production of a serum free medium for use in such bioreactors. Major contracts from Connaught Labs Ltd. and BRT, CBM, totaling nearly \$0.75 million, provided the momentum to catapult the new research

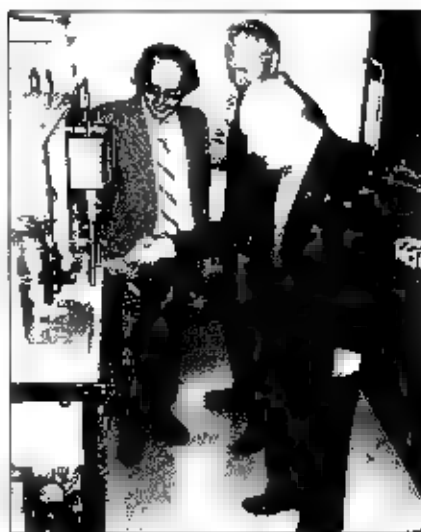


Plate 3.62 Dr. E. L. Toneson, Dr. E. Sian Hall and Mr. William Moore in the Environmental Engineering Lab with two of his researchers. Dr. E. Sian Hall, Research Associate, 978-90 and Mr. William Moore, Chemical Analyst, 974-84. The equipment is used in determining the sulphur content of coke. The AQSTRA sponsored study resulted in a method for reducing SO₂ emissions into the atmosphere from coke burning steam power plants.

organization into *high gear* where it has been running and gaining strength since 1989.

- Two other very successful research projects involving Drs. L.A. Behie and W.Y. Svrcek as co-investigators, dealt with:
 - (i) the development of a process for the production of hydrogen from hydrogen sulfide using a gas fluidized bed reactor, work which led to Canadian and U.S. patents issued to L.A. Behie, D. Berk, P.R. Bishno and W.Y. Svrcek in 1982 and 1984, respectively;
 - (ii) the upgrading of Alberta heavy oils and coals to produce chemical feedstocks by catalytic pyrolysis using a new concept spout fluid bed reactor. A 100 day pilot plant, using such a reactor, was constructed in the Department during 1986-87 using funds from a 3 year \$350,000 industrial contract with the Alberta Energy Corporation, AEC, and Colt Engineering Ltd.
- In situ recovery of bitumen and



Plate 3.64 The Department's two most recent academic staff appointees in the Fall of 1986 are shown here with their families at the annual departmental picnic held at the Tree Farm, 12 miles south of the City on the banks of the Bow River. Left to right: Dr. Mark A. Trebble, Mrs. Alessandra Berruti, Mrs. Shawna Trebble (with her 6-week old baby son Daniel) and Dr. Franco Berruti. Sept. 2, 1986.

- Prof. P. R. Bishnoi continued his pathbreaking research on gas hydrates with support from an EMR/DSS contract (\$39,759, 1983). He initiated studies in natural gas and methane hydrate formation



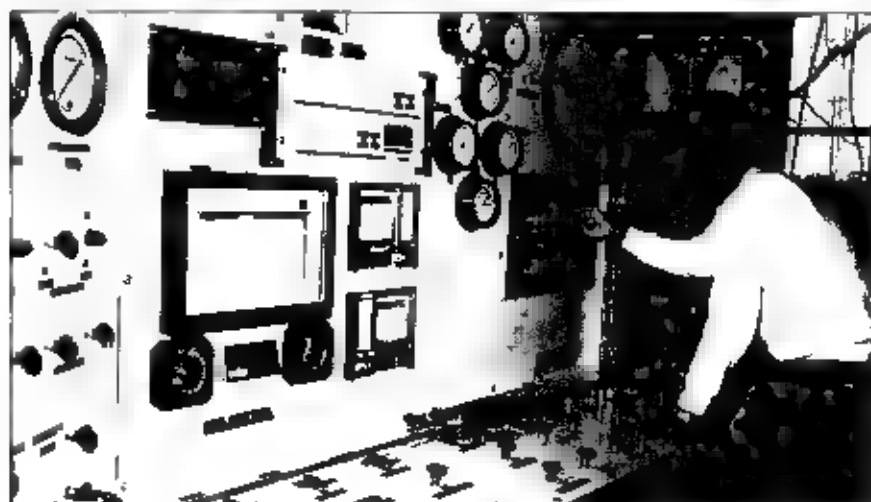
Plate 3.64— The 100 m sprint is being supervised by its organizer Mr Terry Nair standing in the background next to the starting pistol. This event was a quadruped race in the family of Engineering Sports Day. No first time in which was held on June 21, 1981 in the sports playing field area now occupied by the Olympic Oval. The Sports Day was instituted in the 1960s in celebration of the EFC Ad Hoc Committee on Family Mouse (CFMCM) chaired by Dr M F Mouta and was discontinued after construction on the oval was started in the mid 1980s. In R Terry Nair: I (unidentified male) and J (unidentified female) glad student members, unidentified male Mr Mouta, Council Affairs and unidentified female glad student members, unidentified male Mr Mouta, Council Affairs and unidentified female glad student members, unidentified male Mr Mouta, Council Affairs and unidentified female glad student members. The quadruped sprint amongst participants in male events is easily gauged from the effort displayed by some of the runners and by the fact that one of the sprinters was clearly trying too hard to be seen running behind an unidentified female in the area view towards the W. 1981.84

and decomposition. These studies were extended through a 3 year EMR/DSS contract (\$236,516; 1983-86) in which Dr. A.A. Jee was co-applicant. Starting in 1985, Dr. N.E. Kalogerakis became involved in this work when a B. Shnoi/Kalogerakis application for an EMR/DSS contract was successful (\$79,300, 1985-86). While on sabbatical leave during the first 6 months of 1986, R. B. Shnoi initiated discussions with the Norwegian state or company STATOIL-NORWAY which led to a 2 year \$249,541 contract

(1986-88) for modeling gas hydrates flow in pipelines. A further EMR DSS contract, \$59,647 (1986-88) provided funds for related basic studies.

international recognition of this work was underlined by the 2 week visit of Prof Y F Makogon from the Moscow State University in Jan 1988, a visit arranged by EMR through the Canadian JSSP Scientific Exchange Programme (see Plate 3.69). Continuation of the research was guaranteed through funding from the Canadian Gas Processors Assoc. (CGPA, \$10 000 1988-89), EMR/DSS (\$38 000; 1988-89), an NSERC Strategic Grant (\$120 000 1988-91) and a contract with Shell Amsterdam (\$40 000 1989-91); the latter dealing specifically with the kinetics of gas hydrate formation, its deposition in pipelines and the use of emulsifiers. In all of this work Nick Kikioerakis was co-investigator.

- Before becoming involved with Dr. Bishnoi in the study of gas hydrates formation and decomposition, Dr. A. A. Jee was investigating absorption of CO_2 in hydrocarbons and the transient phase behaviour and transport properties of CO_2 and hydrocarbons.



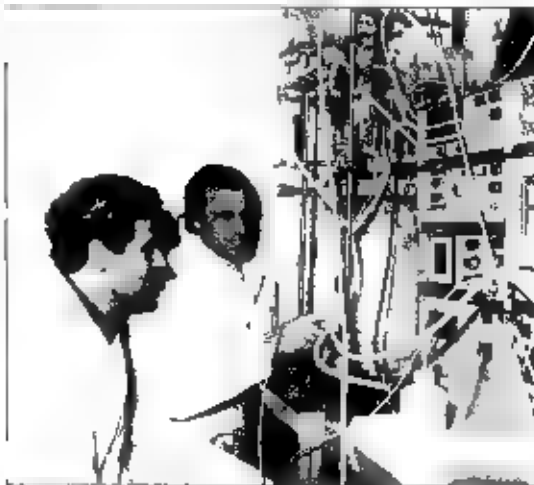
Page 465 P.O. address for DM Helgrave at the main address of the "Production Unit" facility, listing the test heater control equipment, which is computerized and in which it was the software is 946.

[illegible]

study on clay stabilization in the
Cold Lake Heavy Oil reservoirs

- Five years of AOSTRA Professorship, 2 sabbaticals, and a group of outstanding co-workers and students (see Plates 3.13-3.58-3.60), enabled Prof. E. L. Tootson to continue to make significant contributions to the solution of a wide spectrum of hydrocarbon and refinery environment related problems. Particularly successful and productive was his collaboration with Dr. E. Stan Halperin (see Plate 3.62) on desulfurization of coke heavy oils and hydrogen on upgrading of residua from processing of heavy oils and bitumen on the recovery of hydrocarbons from waste tars using flotation techniques and on fluid bed coking studies. Some of his work also dealt with catalytic oxidation of low concentrations of hydrogen sulphide in natural gas, the development of a process for the production of activated carbon from coal and the evaluation of non-bituminous combustibles in waste tarings. Funding for these projects and the support of his research group, totalling over \$1.25 million over the period 1981-91, came primarily from AOSTRA (\$0.98 million), A/C ERRF (\$0.14 million), and from AERT, CGPA and Syncrude Canada Ltd. (\$0.12 million).
- A very successful research partnership developed between Dr. W. Y. Svrcek and his PhD student, A. K. Mehrotra during the late

• Dr. Amir Badakhshan's rich background was applied in a pilot study on the use of ozone for treatment of domestic water supplies. With a 3-year grant from AFRT (\$45,000, 1983-86) and some support from the City of Calgary, a pilot plant was designed and constructed at the Calgary Water Works Glenmore Plant. His studies on enhanced recovery by immiscible flooding of petroleum reservoirs were supported by Shell Canada (\$74,000, 1986-90) and by the Saskatchewan Dep. of Energy and Mines (\$25,000, 1989-90). Esso Resources Canada Ltd. covered a relevant expenses related to



1. *Phragmites australis* (Common Reed)
 2. *Scirpus palustris* (Sedges)
 3. *Cyperus tenuiflorus* (Sedges)
 4. *Eleocharis acicularis* (Sedges)
 5. *Sparganium angustifolium* (Sedges)
 6. *Najas* (Mosses)
 7. *Chara* (Charophytes)
 8. *Utricularia* (Utricularia)
 9. *Alisma* (Alismaceae)
 10. *Sagittaria* (Sagittaria)
 11. *Najas* (Mosses)
 12. *Chara* (Charophytes)
 13. *Utricularia* (Utricularia)
 14. *Alisma* (Alismaceae)
 15. *Sagittaria* (Sagittaria)

1970's and carried over into the decade under review. One of the important projects was a continuation of a study on the viscosity of bitumens initiated by Drs. Donnelly, Stanislaw and Svrcek during the period 1976-1981 and supported by AOSTRA \$203 850. Drs. Svrcek and Mehrotra carried out detailed measurements of the solubility of dissolved gases in bitumen and the effect on the viscosity and density of A-b bitumen gas systems. They used their data to develop correlative and predictive equations for these mixtures. Funding from AOSTRA for this study during the period 1982-89 totaled \$0.68 million. B. Svrcek used NSERC operating funds and grants from PAE to support his work on extraction of metals from fly ash removal of oxides materials from waste waters by foam fractionation and simulation and control of natural gas processes.

- Dr. Anil Mehrotra began his independent research with a project on the treatment of oil sands waste water by membrane processes supported by AOSTRA \$17 000 1981-82. He used NSERC operating funds for an extension of his PhD dissertation in metals recovery from oil sands.

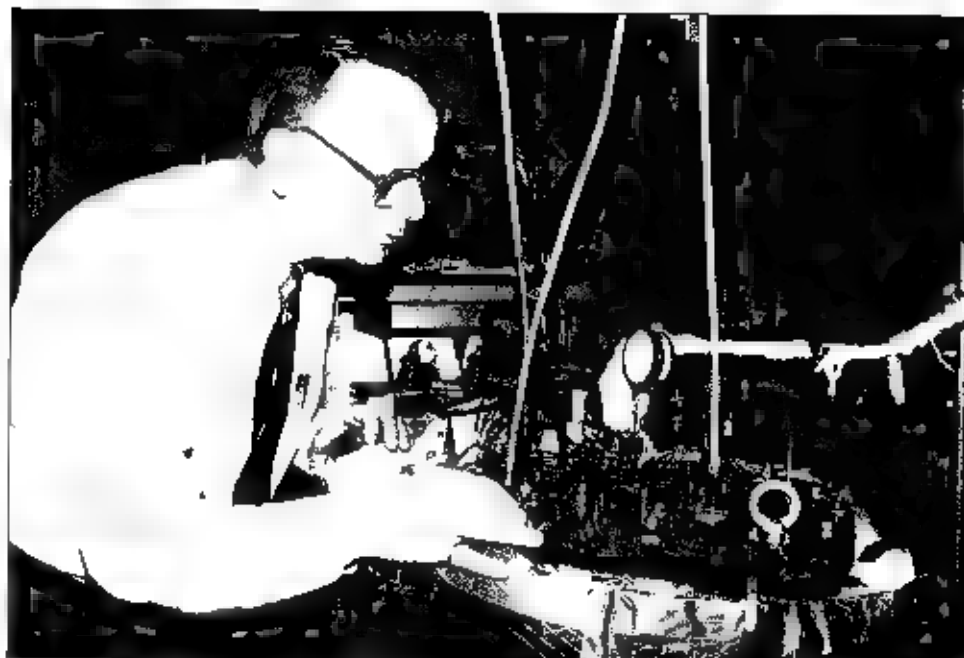


Plate 3-58 Dr. Roger M. Butler, Petroleum Engineering, is examining the numerous thin sections of bitumen core passing through the end of the cylindrical chamber of the steam assisted gravity drainage process using horizontal wells and a central vertical injection well. Prof. Butler's research contributions were recognized most recently by a 1992 ASTech Prize, the inaugural award in the category of outstanding oil sands research. The \$10 000 prize and scroll were presented by the Alberta Science and Technology Leadership Awards Foundation at their annual awards luncheon held at the Westin Hotel in Edmonton Friday, June 23, 1994.

also using high temperature fluid-bed reaction of ash with chlorine and carbon in an AOSTRA funded \$133 300 1986-89 joint project with Dr. N.E. Kalogerakis. He studied phase equilibria of CO₂-bitumen-brine systems, measuring the equilibrium parameters over a range of temperatures and pressures and correlating them.

A most significant event for the Department which influenced its future development occurred in the

spring of 1991. The leasing of the Petro Canada Building to The University of Calgary was announced; the building was assigned to the Faculty of Engineering and, in turn, made available to the Department of Mechanical Engineering, effective Sept. 1991. The B-Block, Mechanical Engineering's home for 24 years, was renovated and turned over to the Department of Chemical and Petroleum Engineering in the summer of 1992, thereby providing the much needed office and some laboratory space. The severe space shortage under which the Department operated for years was thus alleviated. On the other hand, acquisition of B-Block also meant that the possibility of a worthy extension to the Chemical Engineering wing (D-Block), one of the long-standing dreams of the Department, suddenly and once again turned into the recurring goal that it had been for over 2 decades.

Additional highlights and outstanding achievements by staff and students as well as Departmental administrative and personnel history and statistics are indicated in Tables 3-1 to 3-4 at the end of the Chapter.

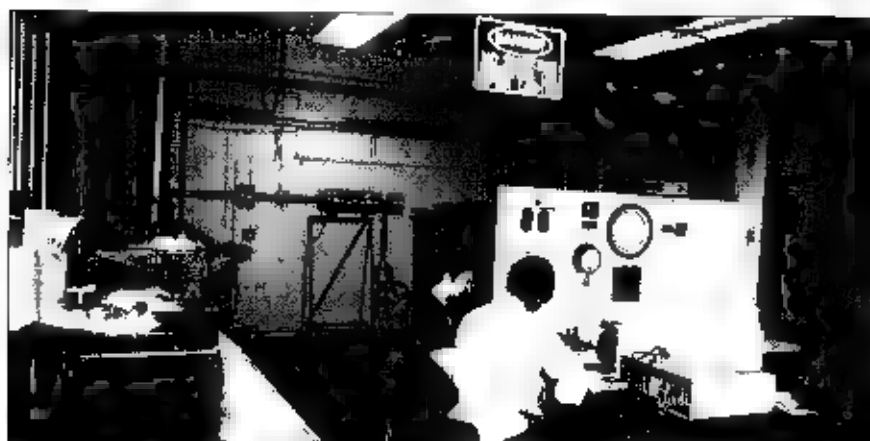


Plate 3-59 Mr. Anil Mehrotra, Mechanical, and Ms. candidate P.D. Dhanraj are installing the data acquisition system for the S-470, Norway Gas Hydrates Pipeline Project. The high-pressure vessel is being filled with gas before the hydrates are applied. (1996)

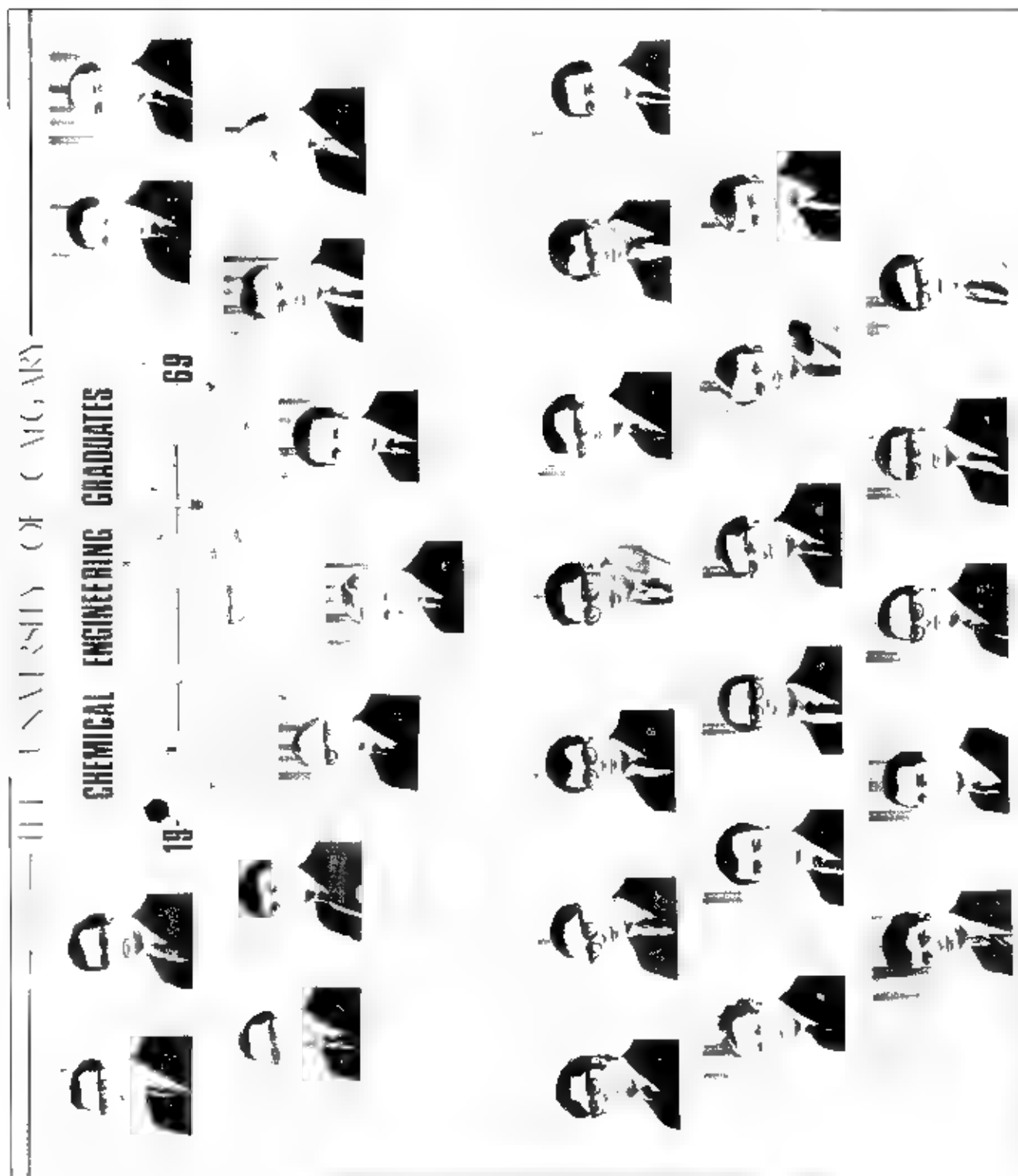


Plate 3.70 — The first Chemical Engineering graduating class — May 1969

Table 3.1 STAFF AND ADMINISTRATION — 1990-91
DEPARTMENT OF CHEMICAL AND PETROLEUM ENGINEERING

| | | |
|--|---|--|
| HEAD: Dr. Heidemann, R.A.
Secretary: Mrs. Wilson, Norma | ACADEMIC STAFF
Dr. Badakhshan, A.
Dr. Behie, L.A.
Dr. Bennion, D.W. (Emerit.)
Dr. Belgrave, J.D.M.
Dr. Berruti, F.
Dr. Bishnoi, P.R.
Dr. Butler, R.M.
Dr. Chakma, A.
Prof. Fogaras, M. (Emerit.)
Dr. Hasiaoglu, M.A.
Dr. Havlena, J.J. (Emerit.)
Dr. Heidemann, R.A. | Dr. Jeje, A.A.
Dr. Kalogerakos, N.E.
Dr. Mehrotra, A.K.
Dr. Mohtad, M.F. (Emerit.)
Dr. Moore, R.G.
Dr. Rhodes, E.
Dr. Sigmund, P.M.
Dr. Stanislav, J.F.
Dr. Svrcek, W.Y.
Dr. Tollefson, E.L.
Dr. Trebbie, M.A.
Dr. Younger, A.H. |
| ASSOCIATE HEAD: Dr. Mehrotra, A.K.
(Graduate Studies) | | |
| CHAIR IN PETROLEUM ENG. Dr. Butler, R.M.
Secretary: Ms. Stuart, Patricia L. | | |
| SECRETARIAL STAFF
Ms. Homan, Connie
Ms. Jeffery, Linda
Mrs. McDonald, Judy (till 90.06.30)
Mrs. Renaud, Lorraine
Mrs. Streets, Jeanne (till 91.05) | VISITING PROFESSORS, RESEARCH ASSOCIATES/
ASSISTANTS, P.D.F.'s AND SESSIONAL INSTRUCTORS
Dr. Benmekk, H. (till 91.04)
Mr. Bui, V.V.
Dr. Czaputowicz, E.
Dr. Dala, A.
Mr. Dhoiabhai, P.D.
Miss Duong, Ma
Mr. Farquharson, S.
Dr. Hall, E.S.
Mr. Hancock, Mark M.
Mr. Hu, Y.
Mr. Iatrou, J.
Mr. Iqbal, S.
Miss Laberge, N.M.
Ms. Laureshen, C.J.
Dr. Majumdar, A. | Dr. Mehta, S.A.
Mr. Milne, B.J.
Dr. Mokrys, I.J.
Dr. Novosad, J.J.
Dr. Okazawa, N.
Mrs. Perk, L.
Dr. Settari, A.
Mrs. Sibbald, Barbara
Dr. Suprunowicz, R.
Mr. Talukder, C.
Ms. Towle, P.
Mr. Umess, C.M.
Mr. Lrsenbach, M.G.
Dr. Walsh, B.W.
Dr. Wong, J. |
| TECHNICAL STAFF
Supervisor: Mr. Kraus, Vince L.
Mr. Dornan, Lawrence M.
Mr. Fantin, Donato
Mr. Grigg, Michael N.
Mr. Kohn, Adolf H.
Mr. McRae, John R. (till 90.12.31)
Mr. Mikalsen, Jan H.
Mr. Miles, Bruce E.
Mr. Neudorf, Jake
Mr. Turner, Ron | | |

Table 3.2 TIME LINE OF ADMINISTRATION - 1966-1992
DEPARTMENT OF CHEMICAL AND PETROLEUM ENGINEERING

| Year | Head | Departmental Secretary | Associate Head(s) | Technical Supervisor |
|------|-------------------------------------|---|--|------------------------|
| 1966 | R.A. Ritter
(07.01-) | M. Neilson
(07.04-12.31) | — | — |
| 1967 | R.A. Ritter | C. Jorgensen
(01.01-) | — | M. Keller
(01.24-) |
| 1968 | M.F. Mohtadi
(08.01-) | C. Jorgensen | — | V.L. Kraus
(07.19-) |
| 1969 | M.F. Mohtadi | D. Jorgensen
(12.01-) | — | V.L. Kraus |
| 1971 | E.L. Tollefson
Acting
(07.01) | D. Jorgensen | — | V.L. Kraus |
| 1972 | E.L. Tollefson
(07.01) | D. Jorgensen | — | V.L. Kraus |
| 1974 | E.L. Tollefson | S. Aspden
(01.02-)
M.A. McCargar
(05.21) | — | V.L. Kraus |
| 1975 | E.L. Tollefson | P. Allen
(0.0-)
J. Donahue
(2.15-) | — | V.L. Kraus |
| 1978 | E.L. Tollefson | A. Taylor
(07.04-)
J. Porter
(10.06-) | — | V.L. Kraus |
| 1981 | R.A. Heidemann
(07.01-) | N. Wilson
(12.14-) | — | V.L. Kraus |
| 1986 | R.G. Moore
Acting
(07.01) | N. Wilson | — | V.L. Kraus |
| 1987 | R.A. Heidemann
(07.01-) | N. Wilson | — | V.L. Kraus |
| 1990 | R.A. Heidemann | N. Wilson | A.K. Mehrotra
(Graduate Studies
1.01-) | V.L. Kraus |
| 1992 | R.G. Moore
(07.01) | N. Wilson | A.K. Mehrotra
(Graduate Studies) | V.L. Kraus |

Table 3.3 STUDENT AND STAFF AWARDS, PRIZES AND ACHIEVEMENTS
DEPARTMENT OF CHEMICAL AND PETROLEUM ENGINEERING, 1966-93

I Undergraduate Scholarship, Medal and Prize Winners

(a) Association of Professional Engineers, Geologists and Geophysicists of Alberta Gold Medal

| | | | | | | | | | | | |
|------|----------------|------|----------------|------|-------------|------|----------------|------|-------------------|------|------------------|
| 1969 | Wallis, J.P.A. | 1973 | Eng, W.W.V. | 1977 | Law, S.K.D. | 1981 | Wong, T.W. | 1985 | Fairburn, J.A. | 1990 | Batycky, R.P. |
| 1970 | Van Hee, G. | 1974 | Ko, C.M.S. | 1978 | Kohse, G.E. | 1982 | Hugo, W.F. | 1986 | Eng, J.H. | 1991 | Forstner, H.J.L. |
| 1971 | Leung, S.T. | 1975 | Fuller, G.G. | 1979 | Y.L.L. | 1983 | Henley, R.D. | 1987 | Dlugogorski, B.Z. | 1992 | Anderson, C.M. |
| 1972 | Herring, I.W. | 1976 | Campbell, J.M. | 1980 | Woods, D.W. | 1984 | McIntosh, A.R. | 1988 | Tse, C.W.K. | 1993 | Kobyika, L.C. |

(b) Society of Chemical Industry Merit Award

| | | | | | | | | | | | |
|------|--------------|------|----------------|------|------------------|------|-------------------|------|-----------------|------|----------------|
| 1969 | Oliver, W.K. | 1974 | Jackson, S.B. | 1978 | Kohse, G.E. | 1982 | Campbell, J.G. | 1986 | Eng, J.H. | 1990 | Delman, S.J. |
| 1970 | Van Hee, G. | 1975 | Fuller, G.G. | 1979 | Taylor, R.M. | 1983 | Burge, R.K. | 1987 | Bjerkseth, J.K. | 1991 | Huq. |
| 1972 | Mah, Y. | 1976 | Campbell, J.M. | 1980 | Stocker, R.K. | 1984 | van Engelen, R.J. | 1988 | Godard, D.C. | 1992 | Anderson, C.M. |
| 1973 | Wallis, A.J. | 1977 | Law, S.K.D. | 1981 | Birkholz, R.K.O. | 1985 | Taylor, M.D. | 1989 | Ritsch, M. | 1993 | Kobyika, L.C. |

(c) Alberta Heritage (Louise McKenney) Scholarship

| | | | | | | | | | | | |
|------|----------------|------|-------------------|------|----------------|------|--------------|------|------------------|------|----------------|
| 1981 | Berg, D.A. | 1982 | Taylor, M.D. | 1984 | Eng, J.H. | 1986 | Tse, C.W.K. | 1989 | Forstner, H.J.L. | 1991 | Thrush, M.C. |
| | Campbell, J.G. | 1983 | Bakes, P.A. | | Fairburn, J.A. | 1987 | Heer, S.R.F. | 1989 | Sawa, M.R. | 1992 | Fookes, R.B. |
| | McIntosh, A.R. | | Fairburn, J.A. | | Taylor, M.D. | 1987 | Strutt, D.B. | 1990 | Forstner, H.J.L. | | Kobyika, L.C. |
| | Yee, C.T. | | McIntosh, A.R. | 1985 | Sauve, R.E. | | Wong, R. | | Kobyika, L.C. | | Thrush, M.C. |
| 1982 | Henley, R.D. | 1983 | Taylor, M.D. | | West, S.L. | 1988 | Heer, S.R.F. | 1991 | Anderson, J.E. | 1993 | Anderson, J.E. |
| | McIntosh, A.R. | | van Engelen, R.J. | 1986 | Sauve, R.E. | | Strutt, D.B. | | Kobyika, L.C. | | Kallos, M.S. |

(d) Dome Petroleum Ltd. Scholarship, Bursary* or Gold Medal & Book Prize†

| | | | | | | | | | | | |
|------|-----------------|------|------------------|------|----------------|------|-----------------|------|-----------------|------|----------------|
| 1967 | Wallis, J.P.A. | 1972 | Koncohrade, K.A. | 1976 | Palmer, D.W. | 1980 | Campbell, J.G. | 1984 | †Fairburn, J.A. | 1986 | †Van Son, K.J. |
| 1968 | Smillie, G.R. | 1973 | Fuller, G.G. | 1977 | Taylor, R.M. | 1982 | *McCue, K.D. | | *Scarath, D.G. | 1987 | †Godard, D.C. |
| 1969 | Leung, S.T.Y. | 1974 | Debruyne, R.P. | 1978 | Pickel, S.D. | | *Safahub, D.W. | 1985 | *Bakes, P.A. | 1988 | †Gates, J.D. |
| 1970 | Anderson, A.B. | 1975 | Walker, L.D. | 1979 | McMullen, A.L. | 1983 | †McIntosh, A.R. | | †Eng, J.H. | | *Pilgrim, D.W. |
| 1971 | Johnson, C.D.W. | | | | | | | | | | |

(e) Shell Canada Resources Ltd. Scholarship

| | | | | | |
|------|---------------|------|---------------|------|-----------------|
| 1976 | Law, S.K.D. | 1981 | Henley, R.D. | 1985 | Van Son, K.J. |
| 1977 | Palmer, D.W. | 1982 | Bennion, D.B. | 1991 | J.L.C. L.T. |
| 1978 | Y.L.L. | | Bray, C.D. | 1993 | Heikkinen, P.A. |
| 1979 | Schmidt, G.C. | 1983 | Bosch, D.J. | | Rojek, L.M. |
| 1980 | Schmidt, G.C. | 1984 | Bakes, P.A. | | |

(f) Home Oil Co. Ltd. Centennial Scholarship

| | | | | | |
|------|---------------|------|---------------|------|-----------------|
| 1979 | Wong, S.K. | 1982 | Bilozir, D.E. | 1984 | Keys, P.M. |
| 1980 | Wong, S.K. | | Hustad, C.M. | | Tse, C.W.K. |
| 1981 | Bilozir, D.E. | 1983 | Hustad, C.M. | 1985 | Tetarenko, P.H. |
| | Dilger, C.W. | | Keys, P.M. | 1989 | Gates, J.D. |
| | Hustad, C.M. | | | | |

(g) John F. Hardy Memorial Bursary

| | | | | | |
|------|--------------------|------|---------------------|------|----------------|
| 1982 | Oberholzer, M.J.C. | 1988 | Wong, R. | 1990 | Stephens, C.M. |
| 1983 | Hancock, S.K. | 1989 | Fouracres, S.C.J.G. | 1991 | Plomp, L.E. |
| 1984 | Bergner, H.L. | | Kowalski, C.B. | | Reynolds, M.A. |
| 1986 | Young, M.G. | | Stephens, C.M. | 1992 | Bulat, D.A. |
| 1987 | Clifford, S.P. | 1990 | Acton, D.W.J. | | Kobyika, L.C. |
| 1988 | Seitz, T.L. | | Wutun, R.O. | | Kostjuk, L.M. |

(h) Orbit Valve Co. Ltd. Bursary

| | | | | | |
|------|------------------|------|---------------------|------|----------------|
| 1984 | Chan, A.D. | 1987 | Seitz, T.L. | 1990 | Redons, M.R. |
| 1985 | Onig, T.S. | 1988 | Hakimallari, K. | 1991 | Reynolds, M.A. |
| | Virginillo, C.B. | | Janser, S.L. | | Sadler, M.J. |
| 1986 | Olmstead, D.E. | 1989 | Nielsen, B.B. | 1992 | J.L.C. L.T. |
| | Stewart, M.D. | | Rae, D.J. | | Puchyr, D.M.J. |
| 1987 | Sauve, R.E. | 1990 | Fouracres, S.C.J.G. | 1993 | Krueger, D.W. |

(i) Hudson Bay Oil and Gas Co. Ltd. Gold Medal & Prize

| | | | | | |
|------|---------------|------|----------------|------|----------------|
| 1970 | Carr, L.A. | 1975 | Campbell, J.M. | 1979 | Stocker, R.K. |
| 1971 | Herring, I.W. | 1976 | Law, D.S.K. | 1980 | Schmidt, G.C. |
| 1972 | Coward, R.S. | 1977 | Palmer, D.W. | 1981 | Campbell, J.G. |
| 1973 | Ko, C.M.S. | 1978 | Yu, L.L.L. | 1982 | Henley, R.D. |
| 1974 | Fuller, G.G. | | | | |

(j) Norcen Energy Ltd. Scholarship in Engineering

| | | | | | |
|------|---------------|------|----------------|------|-----------------|
| 1988 | Bibby, R.S. | 1990 | Gupta, S.K. | | Wilkinson, S.L. |
| | Edwards, M.D. | | Jee, D.F. | 1992 | Bulat, D.A. |
| 1989 | Holmes, B.F. | | Reynolds, M.A. | | J.L.C. L.T. |
| | Wutun, R.O. | 1991 | Heigold, M.L. | | Sodero, S.F. |
| 1989 | Marche, G.K. | | Holoboff, J.L. | 1993 | Gupta, N.K. |

(k) Cactus Drilling Corp. Ltd. Bursary

| | | | |
|------|---------------|------|----------------|
| 1969 | Law, J.K. | 1980 | McKenzie, W.B. |
| 1974 | Fung, B.K.T. | 1981 | Hugo, A.J. |
| 1974 | Padula, M. | 1981 | Spencer, K.M. |
| 1976 | Kelly, N.C. | 1984 | Barrow, J.M. |
| 1977 | Purcell, D.R. | | |

(l) Trans-Alta Utilities Memorial Scholarship

| | | | |
|------|----------------|------|--------------------|
| 1976 | Taylor, R.M. | 1983 | Frederick, D.E. |
| 1978 | McMullen, A.L. | 1985 | Tse, C.W.K. |
| 1979 | Bennion, D.B. | 1986 | Zaharichuk, S.L. |
| 1981 | Bennion, D.B. | 1988 | Kraft, P.B. |
| 1982 | Fairburn, J.A. | 1989 | Graham-Navis, H.L. |

(m) Clifford C. Burton Scholarship

| | | | |
|------|---------------|------|---------------------|
| 1982 | Burge, R.K. | 1988 | Zaharichuk, S.L. |
| 1983 | Bennion, D.B. | 1989 | Batycky, R.P. |
| 1984 | Kahoe, T.J. | 1990 | Fouracres, S.C.J.G. |
| 1985 | Eng, J.H. | 1991 | Graham-Navis, H.L. |
| 1986 | van Son, K.J. | 1992 | Steinicke, A.O. |
| 1987 | Godard, D.C. | 1993 | Christie, H.L. |

(n) Dow Chemical Scholarship

| | | | |
|------|-------------------|------|--------------------|
| 1981 | Saeger, R.B. | 1987 | Tse, C.W.K. |
| 1982 | Wee, W. | 1988 | Byers, S.D. |
| 1983 | Berg, D.A. | 1989 | Pilgrim, D.W. |
| 1984 | Young, L.R. | 1990 | Langenberger, C.E. |
| 1985 | Ross, K.B. | 1991 | Gupta, S.K. |
| 1986 | Dlugogorski, B.Z. | 1992 | Puchyr, D.M.J. |

(o) Edward A. Galvin Scholarship

| | | | |
|------|-------------------|------|--------------------|
| 1983 | Gullherme, C.J. | 1989 | Langenberger, C.E. |
| 1984 | Hancock, S.K. | 1990 | Nielsen, B.B. |
| 1985 | Dlugogorski, B.Z. | 1991 | Boras, W.M. |
| 1986 | Barrow, J.M. | 1992 | Dancey, J.J. |
| 1987 | Warholm, R.R. | 1993 | Nelson, T.K. |
| 1988 | Ritsch, M. | | |

(p) Chevron Canada Resources Ltd. Sch

| | | | |
|------|----------------|------|--------------------|
| 1973 | Jackson, S.B. | 1984 | Bosh, D.J. |
| 1975 | Moynihan, T.J. | 1985 | Nighswander, J.A. |
| 1978 | Su, C.P. | 1986 | Monnery, N.D. |
| 1981 | Hugo, W.F. | 1990 | Langenberger, C.E. |
| 1982 | Bilozir, D.E. | | |

(q) The Champion Petroleum Co. Scholarship

| | | | |
|------|----------------|------|-----------------|
| 1979 | Campbell, J.G. | 1982 | Yee, C.T. |
| 1980 | Hugo, W.F. | 1983 | McCue, K.D. |
| | Safahub, D.M. | | Schlenker, R.C. |
| 1981 | O'Connor, S.G. | 1987 | Unser, S.L. |

(r) Cominco Ltd. Scholarship

| | | | |
|------|------------------|------|--------------|
| 1969 | Carr, L.A. | 1974 | Chiu, S.W.W. |
| 1970 | Herring, W. | 1975 | Law, S.K.D. |
| 1972 | Ko, S.C.M. | 1976 | Kohse, G.E. |
| 1973 | McWilliams, J.P. | | |

(s) William Lemond Hamilton Bursary

| | | | |
|------|----------------|------|---------------|
| 1986 | Piers, J.J. | 1989 | Batycky, R.P. |
| 1987 | Pilgrim, D.W. | 1990 | Carlson, S.W. |
| 1988 | Hakumattar, K. | 1991 | Sadler, M. |
| | Unser, S.L. | 1993 | Burns, D.J. |

I Undergraduate Scholarship, Medal and Prize Winners (cont'd)

(t) Canadian Western Natural Gas Co Undergraduate Scholarship in Engineering

1969 Carr, L.A.
1979 Freeman, L.W.
Wong, T.W.

1982 McCue, K.D.
1983 Kehoe, T.J.

(u) Robert B. Pugh Memorial Bursary in Engineering

1968 Carr, L.A.
1969 Prestibaldo, C.A.
1973 Chiu, S.W.

1979 Hugo, W.F.
1985 Liu, T.Q.
1988 Fourcres, S.C., G.

(v) Archibald Wayne Dingman Memorial Scholarship

1980 Birkholz, R.K.O.
1982 Kappelhoff, R.L.
Mallabone, C.L.

1983 Chow, Y.Y.
1986 Liu, T.Q.
1988 Dalman, S.J.

(w) Dr. Alex Petrovic Memorial Scholarship

1974 Hanlon, G.C.F.
1977 Schilling, I.A.
1979 Wallace, J.A.

1980 Khourieh, A.A.
1981 Burge, R.K.
1983 Serhal, K.E.

(x) Petro Canada Scholarship

1980 Dilger, C.W.
McMullen, A.L.
1981 Harrison, D.M.

1982 Berg, D.A.
Bradley, S.E.
1983 Mallabone, C.L.

(y) John W. Gregg Memorial Bursary

1986 Cote, D.J.
1987 Hakimlathar, K.
1988 Stillwell, D.R.
1989 Holowach, N.L.

1990 Holowach, N.L.
1991 Young, B.
1992 Dancsey
1993 Chin, H.S.F.

(z) Canada Scholarships

1990 Anderson, C.M.
Telang, L.V.
Kobylika, L.C.
1991 Anderson, C.M.
Kobylika, L.C.
1992 Kobylika, L.C.

1992 Thrush, M.C.
1993 Anderson, J.E.
Heikkinen, P.A.
Kallio, M.S.
Pollock, A.E.
Rojek, L.M.

(α) Petroleum Society of C.M. Calgary Section Scholarship

1978 Brade, D.R.
1979 Newman, R.J.
1980 Hugo, A.J.
1981 Burge, R.K.
Wee, N.
1982 Joa, B.M.

1984 Nighswander, J.A.
1985 Barrow, J.M.
1986 Godard, D.C.
1987 Godard, D.C.
1988 Driscoll, D.

(β) Chemical Engineering Society Prize

1985 Dlugogorski, B.Z.
1986 Olmslead, D.E.
1987 Warholm, R.R.
1988 Heer, S.R.F.R.
1989 Balycky, R.P.
1989 Huq,

1990 Huq
1991 Anderson, C.M.
Luk, L.T.
1992 Kobylika, L.C.
1993 Norem, A.D.
Thrush, M.C.

(γ) Others

1968 Wallis, J.P.A.
1969 Jackson, D.L.
1970 Carr, L.A.
1971 Gerus, B.R.D.
Gerus, B.R.D.
1973 Fung, K.T.B.
Jackson, S.B.
Annamanahadoo, A.V.
1975 Hanlon, G.C.F.
1976 Purcell, D.R.
Six, C.P.
Yee, L.L.
1977 Bailey, R.B.
Cummins, A.G.
Yee, P.W.F.
Yee, L.L.
1978 Salahub, D.M.
1979 Cole, D.H.
Padamsay, R.P.
Saeger, R.B.
Salahub, D.M.
Shoroff, R.G.
1980 Campbell, J.G.
Henley, R.D.
Saeger, R.G.
Salahub, D.W.
Yee, L.T.
Wee, W.
1981 Harrison, D.M.
Kappelhoff, R.L.
Leung, R.W.K.
McCue, K.D.
Nevison, G.W.
Schlenker, R.C.
1982 Harrison, D.M.

Canada-Cities Service Petro. Corp. Scholarship
Canada-Cities Service Petro. Corp. Scholarship
R.J. Brodenck Memorial Scholarship
Viscount Bennett Scholarship
Cdn. Natural Gas Proc. Assoc. Book Prize
Standard Oil (Indiana) Foundation Scholarship
Cdn. Natural Gas Processors Assoc. Book Prize
APEGGA Scholarship in Engineering
Canada-Cities Service Petro. Corp. Scholarship
Pacific Petroleum Ltd. Scholarship
Canadian Bechtel Ltd. Bursary
Canadian Bechtel Ltd. Bursary
Pacific Petroleum Ltd. Scholarship
W.G. (Bill) Howard Memorial Foundation Bursary
Prof. Engineer's Wives Club of Calgary Bursary
Goliad Oil & Gas Co. Bursary
Trotter & Morton Ltd. W. Watson Bursary
Pacific Petroleum Ltd. Scholarship
Trotter & Morton Ltd. W. Watson Bursary
Sun Oil Co. Ltd. Scholarship in Engineering
Goliad Oil & Gas Co. Bursary
Amoco Canada Petroleum Co. Ltd. Scholarship
W.H.B. Sharp Memorial Scholarship in Eng.
Goliad Oil & Gas Co. Bursary
Schlumberger Collegiate Award
Stevens Graham McConnell Milton Partners Sch.
Canadian Bechtel Ltd. Bursary
Canadian Bechtel Ltd. Bursary
EIC Calgary Branch Scholarship
APEGGA Scholarship in Engineering
ADM Hunter Ltd. Scholarship
Tony Neidermayer Memorial Bursary
W.H.B. Sharp Memorial Scholarship in Eng.
Canadian Bechtel Ltd. Bursary
Monenco Scholarship

1982 Scarth, B.R.
Sing, G.
1983 Kappelhoff, R.L.
Webster, C.D.
Holuk, M.R.
McIntosh, A.R.
Serhal, K.E.
Westby, S.V.
1985 Fairburn, J.A.
Geeraert, D.B.
Yan, W.C.W.
1986 Bjerkaseth, J.K.
Heer, S.R.F.
Johnson, K.B.
Liebe, H.R.
MacKinnon, C.
West, S.L.
Yan, W.C.W.
1987 Sauve, R.E.
Tse, C.W.K.
1988 Gates, J.D.
Litorco, F.R.
Litun, R.O.
Tse, C.W.K.
1989 Dalman, S.J.
Derksen, D.R.
Huq,
Wong, R.
1990 Anderson, C.M.
Rae, D.
1991 Kobylika, L.C.
Robertson, C.A.
1992 Huppig, R.V.
Kostluk, L.M.
Kostluk, K.J.T.

BP Canada Scholarship
Trotter & Morton Ltd. W. Watson Bursary
Schlumberger Collegiate Award
W.G. (Bill) Howard Memorial Foundation Bursary
Centennial Ukrainian Committee Prize
Mune Kovitz Prize
Tony Neidermayer Memorial Bursary
W.G. (Bill) Howard Memorial Foundation Bursary
EIC Engineering Student of the Year Medal
Gerald Roberts & Victor Emanuel Mortimer Sch.
W.C. Support Staff Undergraduate Bursary
Tony Neidermayer Memorial Bursary
Underwood McEwan Ltd. Scholarship
Gerald Roberts & Victor Emanuel Mortimer Sch.
Tony Neidermayer Memorial Bursary
Monenco Scholarship
Canadian Assoc. of Drilling Engineers Sch.
U.C. Support Staff Undergraduate Bursary
Canadian Assoc. of Drilling Engineers Sch.
W.G. (Bill) Howard Memorial Foundation Bursary
Amoco Canada Petroleum Co. Ltd. Award
W.H.B. Sharp Memorial Scholarship in Eng.
Dominion Oilfields Supply Co. Ltd. Bursary
EIC Engineering Student of the Year Medal
Canadian Association of Drilling Engineers Sch.
Ausquacan Energy Ltd. Bursary
Suncor Inc. Scholarship in Engineering
Wayne Hugo Memorial Scholarship
EIC Calgary Branch Scholarship
Wayne Hugo Memorial Scholarship
Amoco Canada Petroleum Co. Ltd. Sch.
Wayne Hugo Memorial Scholarship
Union Pacific Resources Inc. Scholarship
Amoco Canada Petr. Co. Ltd. Scholarship
Wayne Hugo Memorial Scholarship

II Graduate Scholarship, Medal and Prize Winners

(a) NRC/NSERC Postgraduate Scholarship

1969 Wenkoff, M.P.
1970 Gupta, Y.P. (3 yrs)
Thusoo, A.K.
Van Hee, G. (2 yrs)
1971 Carr, L.A. (2 yrs)
Economopoulos, A.
1972

1972 Leung, S.T.Y.
1976 De Bruijn, R.T.
1983 Henley, R.D. (2 yrs)
Stocker, R.C.
Saeger, R.B. (2 yrs)
Trebble, M.A. (2 yrs)

1984 Bennion, D.B. (2 yrs)
Berg, D.A.
Kappelhoff, R.L.
Mallabone, C.L.
Simandl, J. (2 yrs)
Sheldon, D.A.

1984 Karmann, M.G. (2 yrs)
1985 Trebble, M.A.
1986 Bennion, D.B. (4 yrs)
Eng, J.H. (2 yrs)
Fairburn, J.A. (2 yrs)
Sauve, R.E. (2 yrs)

1989 Meszaros, G. (2 yrs)
Milne, B. (2 yrs)
1990 Tse, C.W.K. (2 yrs)
1991 Monnery, W. (2 yrs)
Pugsley, T.
Wong, R.

(b) Alberta Oil Sands Technology and Research Authority Scholarship

1979 Adegbesan, K.O. (3 yrs)
Chaniker, E.M.
Kulkarni, T.G.
1981 Belgrave, J.D.M. (2 yrs)
P.D.F.

1983 Rao, D.M.
1984 Johnson, S.E.
Sibbald, L.R. (4 yrs)
Yee, C.T. (2 yrs)

1985 Belgrave, J.D.M. (2 yrs)
Chung, K.H. (3 yrs)
Oballa, V.
1986 Nighswander, J.A. (3 yrs)

1986 Sengupta, S. (3 yrs)
Sim, K. (2 yrs)
Wozniak, W. (2 yrs)
1987 Eastick, R.R. (2 yrs)

1987 Monnery, W.D.
1990 Gomez, P.
Gupta, S.C. (2 yrs)
Kohse, B.

II Graduate Scholarship, Medal and Prize Winners (cont'd)

(c) Others

| | | | | | |
|------|-------------------|--|------|---------------------|---|
| 1969 | Lamb, A. | NRC Post Industrial Experience Research (PIER) Fellowship (3 years) | 1986 | Ismailuddin, A.K.M. | Canadian Commonwealth Scholarship (5 years) |
| | Wenkoff, M.P. | NRC PIER Fellowship (3 years) | | Patence, G.S. | Home Oil Co. Ltd. R.A. Brown Jr. Memorial Fellowship |
| 1972 | Bradley, K. | Province of Alberta Graduate Fellowship | 1987 | Englezos, P. | Alberta Research Council (ARC) Scholarship |
| | Lamb, A. | Shell Canada Ltd. Fellowship in Engineering | | Hossain, M.S. | Canadian Commonwealth Scholarship (2 years) |
| | McCaffery, F.G. | Geoffrey Abbott Gaherty Memorial Sch. in Eng. | | Yang, G. | Gov. of Alb. Grad. Scholarship in Petroleum Engineering, Heilongjiang (2 years) |
| 1974 | Younas, M. | Canadian Commonwealth Scholarship | 1988 | Englezos, P. | Izaak Walton Killam Memorial Scholarships (2 yrs.) |
| 1975 | Mandhane, J.M. | Province of Alberta Graduate Fellowship | | Mukherjee, J. | Alberta Research Council Scholarship |
| 1976 | Hayashitani, M. | Robert B. Paugh Memorial Bursary | | Mukherjee, J. | Prov. of Alb. Graduate Scholarship |
| 1977 | Hayashitani, M. | Izaak Walton Killam Memorial Scholarship | 1989 | Sriram, P.G. | Canadian Commonwealth Scholarship (4 years) |
| 1977 | Mehrotra, A.K. | Izaak Walton Killam Memorial Scholarship (3 years) | 1990 | Neguz, A. | Archibald Wayne Dingman Memorial Graduate Sch. |
| 1979 | Berk, D. | Izaak Walton Killam Memorial Scholarship (2 years) | | Tse, C.W.K. | Ralph Steinhilber Award of Distinction (2 yrs.) |
| | Damiani, D.N. | Social Sciences and Humanities Research Council Cultural Exchange Scholarship | | Tse, C.W.K. | Robert B. Paugh Memorial Bursary in Engineering |
| | Nzekwu, B.I. | Canadian Commonwealth Scholarship | 1991 | Anhorn, J. | Amoco Canada Graduate Fellowship in Chem. & Petr. Eng. |
| 1980 | Abou-Kassem, J.H. | Hudsons Bay Oil and Gas Co. Ltd. Grad. Fellowship | | Gupta, S. | Harry & Laura Jacques Bursary |
| 1981 | Yuen, B.B.W. | Inter-Can Scholarship in Petroleum Studies | 1992 | Pugsley, T. | Archibald Wayne Dingman Memorial Graduate Sch. |
| 1983 | Simandl, J. | Province of Alberta Graduate Scholarship | | Baker, R.O. | Canadian Well Logging Society Scholarship |
| 1985 | Xi, K. | Gov. of Alb. Graduate Scholarship in Petroleum Engineering, Heilongjiang (2 years) | | Baker, R.O. | Home Oil Co. Ltd. R.A. Brown Jr. Mem. Fellowship |
| 1986 | Goulet, D. | Fonds Pour la Formation de Chercheurs et l'Aide à la Recherche (FCAR) | | Farrell, P.J. | Prov. of Alberta Graduate Scholarship |
| | Kokai, S. | Harry & Laura Jacques Bursary | | Fernow, K.A. | Amoco Canada Grad. Fellowship in Chem. & Petr. Eng. |
| | | | | Nielsen, B.B. | Society of Petroleum Engineering Scholarship |
| | | | | Win, T. | World Bank Scholarship |

III Staff Awards and Achievements

| | | | | | |
|------|---------------------------------|---|------|---|--|
| 1964 | Govier, G.W. | Chemical Inst. of Canada R.S. Jane Memorial Lecture Award | 1982 | Behie, L.A. | Cdn. Patent: A Process for Producing Hydrogen from Hydrogen Sulphide in a Gas Fluidized Bed Reactor |
| | Govier, G.W. | Cdn. Nat. Gas Processors Assoc. Award of Merit | | Berk, D. | |
| 1966 | Govier, G.W. | President, CIM 1966-67 | | Bishnoi, P.R. | |
| 1967 | Govier, G.W. | Univ. Michigan's SesquiCentennial Award | | Svrcek, W.Y. | |
| | Govier, G.W. | Centennial Medal of Canada | 1982 | Stanislav, J.F. | 'Mathematical Modelling of Transport Phenomena Processes' Ann Arbor Science Publisher |
| | Govier, G.W. | Life Membership in APEA | | Tollefson, E.L. | Awarded AOSTRA Professorship, 1982-1985 |
| | Tollefson, E.L. | Cdn. Patent: 'Alkali Metal Cyanide Preparation' (with McGirr, D.J. & Clunie, J.C.) | 1983 | Heidemann, R.A. | Invited to Technical University of Denmark as Visiting Scholar for 2 week period |
| 1968 | Govier, G.W. | Cdn. Patent: 'Acetonitrile Process' (with Johnson, C.B.) | | Badakhshan, A. | Elected Fellow of the Inst. of Petroleum, U.K. |
| | Tollefson, E.L. | Elected Fellow of EIC | | Behie, L.A. | U.S. Patent: A Process for Producing Hydrogen from Hydrogen Sulphide in a Gas Fluidized Bed Reactor |
| 1969 | Tollefson, E.L. | Cdn. Patent: 'Preparation of a Catalyst for Dehydrogenation of Alcohols' (with Gishler, P.E.) | | Berk, T. | |
| | | Cdn. Patent: 'Process for Production of Fatty Nitriles' (with Trevo, L.W. and Myers, M.E.) | | Bishnoi, P.R. | |
| 1970 | Ritter, R.A. | Elected Fellow, Chemical Institute of Canada | | Svrcek, W.Y. | |
| | Tollefson, E.L. | Cdn. Patent: 'Di-Tertiary Butyl Peroxide' (with Davies, T.G.) | 1984 | Butler, R.M. | PS CIM's 'Best Paper' Award for 1984 |
| | | Cdn. Patent: 'Prilling of Formaldehyde' (with Trevo, L.W., Smyke, S.E., Dornan, L.M. & Allenby, G.M.) | | Heidemann, R.A. & Jey, A.A. & Mohtadi, M.F. | An Intro. to the Properties of Fluids and Solids, The J of C Press |
| 1971 | Tollefson, E.L. | Cdn. Patent: 'Dehydrogenation of Alcohol' (with Davies, T.G.) | 1985 | Svrcek, W.Y. | Certificate of Appreciation from Society for Computer Simulation, SCS |
| 1972 | Govier, G.W. & Aziz, K. | Cdn. Patent: 'Epoxidation of Olefins' (with Davies, T.G.) | | Tollefson, E.L. | Awarded AOSTRA Professorship, 1985-87 |
| | Mohtadi, M.F. | 'The Flow of Complex Mixtures in Pipes' van Nostrand Reinhold Co. | | Butler, R.M. | PSCIM's 'Best Paper' Award for 1986 |
| | Rowe, R.D. | Elected Fellow Inst. of Chem. Engineers - London | | Jey, A.A. | Appointed Adjunct Prof. of Biological Sciences, Faculty of Science, The U. of C. |
| 1973 | Mohtadi, M.F. & Heidemann, R.A. | NRC Senior Industrial Fellowship | | Kalogerakis, N.E. | Students Union Superior Teacher Award |
| | | 'The Properties of Gases and Liquids' 1st Ed. U. of C. Printing Office, 289 pp. | | Tollefson, E.L. | Cdn. Jour. of Chem. Eng. 'Best Paper' award for 1986 (with T.K. Ghosh) |
| 1974 | Aziz, K. | Elected Fellow of Chemical Inst. of Canada | 1987 | Butler, R.M. | CSCHE's R.S. Jane Memorial Lecture Award for 1987 |
| 1975 | Mohtadi, M.F. | Elected Fellow of Chemical Inst. of Canada | | | Distinguished Lecturer of the U.S. Society of Petr. Engineers, Sept. 1987-July 1988 |
| | Aziz, K. | Distinguished Service Award of the Petr. Society of CIM, PS CIM | | | CSCHE's Esso Petr. Canada Ltd. Award in Industrial Practice |
| 1976 | Moore, R.G. | Students Union Master Teacher Award | 1988 | Tollefson, E.L. | L.N. Development Programme Fellowship |
| 1977 | Aziz, K. | Killam Resident Fellowship | | Hastaglu, M.A. | Students Union Teaching Excellence Award |
| | Aziz, K. | Appointed Director and Manager of Computer Modelling Group, CMG | | Mehrotra, A.K. | Esso Resources Canada Ltd. Technical Award |
| | Bennion, D.W. | Awarded first AOSTRA Professorship at The U. of C, 1977-1980 | 1989 | Badakhshan, A. | Distinguished Service Award from the PS of CIM |
| | Heidemann, R.A. | Elected Fellow, Chemical Inst. of Canada | | Butler, R.M. | Proficiency Medal of CIM - District No. 5 |
| | Stanislav, J.F. | DAAD Award, Germany | | Moore, R.G. | Inst. of Ch. Science and Technology ICST Service Award |
| 1978 | Heidemann, R.A. & Mohtadi, M.F. | 'Fundamentals of the Three Phases of Matter' The J. of C. Printing, Services 350 pp. | 1990 | Bishnoi, P.R. | Leader of Canadian Delegation to CSCHE, IICHe Joint Symp. in India |
| 1979 | Aziz, K. & Setfari, A. | 'Petroleum Reservoir Simulation' Applied Science Publ. London, 476 pp. | | Butler, R.M. | Elected Fellow of PS of CIM |
| | Aziz, K. | 'Gradient Curves for Well Design and Analysis', PS CIM Monograph No. 20, 197 pp. | | Butler, R.M. | Esso Resources Significant Innovation Award for 1990 |
| | Eickmeier, J.R. | | | Moore, R.G. | Elected Fellow of CSCHE |
| | Fogarasi, M. | | | Moore, R.G. | Students Union Teaching Excellence Award |
| | Gregory, G.A. | | 1991 | Moore, R.G. | Selected for PS of CIM's Distinguished Member Roll |
| | Aziz, K. | Cedric K. Ferguson 'Best Paper' Award of the Soc. of Petr. Eng. of AIME (with G.S. Brar) | | Bishnoi, P.R. | Elected Fellow of Chemical Inst. of Canada |
| | Bennion, D.W. | Best Paper Award of the Can. J. Petro. Technology (with Ejlogu, G.C.) | | Butler, R.M. | PSCIM's 'Best Paper' Award for 1991 |
| | Donnelly, J.K. | | | Butler, R.M. | 'Thermal Recovery of Oil and Bitumen' Prentice Hall, 528 pp. |
| | Moore, R.G. | | | Chakma, A. | Cdn. Patent: Jet Cracking: A Process to Reduce viscosity of Heavy Oils |
| 1980 | Bennion, D.W. | AOSTRA Professorship, 1980-1982 | 1992 | Stanislav, J.F. | DAAD Award, Germany |
| | Rowe, R.D. | Killam Resident Fellowship | | Butler, R.M. | Distinguished Lecturer of the US Soc. of Petr. Eng., 1992-93 |
| 1981 | Moore, R.G. | Elected Fellow of Chemical Inst. of Canada | | Butler, R.M. | Innovation in Oil Sands Research Prize from Alb. Science and Technology ASTech. Leadership Awards Foundation |
| | Sigmund, P.M. | 'Enhanced Oil Recovery' PS CIM Monograph | | | |

Table 3.4 LIST OF ACADEMIC AND SUPPORT STAFF — 1966-91
DEPARTMENT OF CHEMICAL AND PETROLEUM ENGINEERING

ACADEMIC STAFF

| | | | | | |
|------------------|--------------------------|-------------------|--------------------------|-----------------|--------------|
| Anderson, N. E. | 1973-1975 | Flock, D. | 1968-1969 | Mokrys, I. | 1989-1991 |
| Andre, H. | 1966-present* | Fogarasi, M. | 1970-present Emerit '87) | Moore, J. W. | 1974-1984 |
| Aziz, K. | 1965-1982 | Govier, G. | 1963-1975 | Moore, R. G. | 1970-present |
| Badakhshan, A. | 1982-present | Gregory, G.A. | 1968-1983 | Novosad, J.J. | 1982-present |
| Behie, L. A. | 1977-present | Hall, S. | 1971-1988 | Rhodes, E. | 1990-present |
| Belgrave, J.D.M. | 1989-present | Hastanoglu, M.A. | 1982-1992 | Rice, R. G. | 1968-1971 |
| Benmekki, H. | 1989-1991 | Havlena, J.J. | 1968-present Emerit '89) | Ritter, R. A. | 1966-1974 |
| Bennion, D. W. | 1965-present Emerit '86. | Heidemann, R. A. | 1968-present | Rowe, R. D. | 1969-1981 |
| Berruti, F. | 1986-present | Jeje, A.A. | 1980-present | Sayegh, S. | 1983-1990 |
| Bishnoi, P.R. | 1975-present | Kalogerakis, N.E. | 1983-present | Settari, A. | 1978-present |
| Butler, R.M. | 1982-present | Lee, T.S. | 1979-1980 | Sigmund, P.M. | 1981-present |
| Chakma, A. | 1988-present | Mattar, L. | 1977-1980 | Stanislav, J.F. | 1968-present |
| Czaputowicz, E. | 1983-1991 | McDuffie, N.G. | 1969-1984 | Svreck, W.Y. | 1975-present |
| Donnelly, J. K. | 1968-1981 | Mehrotra, A.K. | 1981-present | Tollefson, E.L. | 1967-present |
| Duffy, J. | 1975-1976 | Mohiad, M.F. | 1967-present Emerit '87) | Trebbie, M.A. | 1986-present |
| | | | | Younger, A.H. | 1964-present |

SUPPORT STAFF

| Secretarial | | Technical | |
|------------------------|--------------|-------------------|------------------------|
| Allen, P. | 1972-1975 | Bessler, C. | 1968-1970 |
| Bartlett, J. | 1985-1987 | Baner, R. | 1967-1979 |
| Bundgaard, D. | 1976-1981 | Davison, R. | 1980-1981 |
| Christensen, A. | 1976-1977 | Dorman, L.M. | 1971-present |
| Donahue, J. | 1975-1978 | Eaton, R. | 1967-1972 |
| Flynn, S. | 1981-1989 | Elder, K. | 1975-1977 |
| Habkirk, W. | 1973-1975 | Fantini, D. | 1979-present |
| Hamilton, D. | 1972-1973 | Fitch, B. | 1972-1976 |
| Homan, C. | 1989-present | Gibson, B. | 1977-1979 |
| Hurt, A. | 1979-1981 | Grigg, M.N. | 1985-present |
| Jeffery, L. | 1990-present | Keller, M. | 1967-1968 |
| Jolly, P. | 1982-1985 | Kelly, R. | 1982-1985 |
| Jorgenson, D. | 1969-1973 | Kendrick, K. | 1981-1986 |
| Long, C. | 1968-1971 | Kohl, A.H. | 1982-present |
| Manning, L. | 1967-1971 | Kraus, V.L. | 1967-present |
| McCargar, M. | 1974-1975 | Larson, K. | 1968-1974 |
| McCurach, M. | 1970-1973 | Lundberg, P. | 1979-1982 |
| McCusker, C. | 1968-1971 | Marshall, R. | 1968-1979 |
| McDonald, J. | 1987-1990 | McRae, J.R. | 1981-1990 |
| Medinatta, R. | 1979-1981 | Mikelson, J.H. | 1986-present |
| Mills, J. | 1967-1968 | Miles, B.E. | 1991-present |
| Mudge, P. | 1977-1978 | Neudorf, J. | 1982-present |
| Oberhammer, B. | 1974-1977 | Ott, D. | 1968-1973 |
| Paul, J. | 1969-1971 | Raybould, B. | 1985-1986 |
| Piller, C. | 1967-1969 | Senger, J. | 1975-1980 |
| Pittman, E. | 1978-1979 | Skinner, S. | 1974-1978 |
| Porter, J. | 1978-1981 | Storrie, T. | 1981-1982 |
| Renaud, L. | 1988-present | Towie, P. | 1979-1980 |
| Roxburgh, L. | 1967-1976 | Turnbull, D. | 1967-1968 |
| Schmaltz, J. | 1981-1988 | Turner, R. | 1968-1980-1986-present |
| Seifert, C. | 1980-1982 | Van Der Ploeg, G. | 1977-1979 |
| Streets, J. | 1988-1991 | Worobek, G. | 1968-1971 |
| Stuart, P.L. | 1984-present | | |
| Trattner, J. (Wellis) | 1977-1979 | | |
| Jagerslev, C. (Graham) | 1967-1969 | | |
| Wilson, N. | 1981-present | | |

*On Political Leave Since 1973



Plate 3.71 — The east end of the Third Floor of D-Block as seen from across the Central Court Yard — Winter 1970-s

A Place of
INGENUITY

IV.

Department of
CIVIL
ENGINEERING

THE SILVER ANNIVERSARY

During 1990-91 the Department of Civil Engineering operated with 166 students registered in its various programmes, including 87 undergraduate, 73 graduate and 6 diploma students. In addition, it provided educational experience to a substantial portion of the Faculty's 162 unclassified and 21 visiting students through its various undergraduate and graduate course offerings, the latter numbering 25. Its teaching and research activities involved 21 academic, 5 secretarial and 10 technical support staff as well as a group of 21 research associates/assistants, PDF's and sessional instructors (see Table 4.1 and Plates 4.1 and 4.2).

The Department continued to play a key role in the Faculty's graduate and research programmes. Its graduate enrollment, including 19 and 3 PhD, 20 and 2 MSc and 3 and 26 MEng full- and part-time students, respectively, was the highest of any department in Engineering. Three of the MSc and 4 of the MEng students were women, the latter of whom included one full-time registrant (see Fig. 4.1). Particularly impressive was the strength and continuing rapid growth of the Project Management Specialization, a new programme initiated in 1983 which posted 13 of the MEng and a 6 of



Plate 4.1 The Civil Engineering secretarial staff with Dr. Nigeel G. Shrivie, Head of the Department. L to R: Mrs. Pail Sherman, Ms. Carolyn MacArthur, Mrs. Susan Anand, Mrs. Kayla Takaka and Mrs. Rene Kadach (seated). 1991

the Diploma registrants. The Fall 1991 graduate enrollment is equally impressive with 84 graduate and 7 diploma students, the former including 26 PhD, 21 MSc and 37 MEng registrants, the latter of which comprises 1 international co-op and 18 Project Management students.

With such record graduate student numbers, it is not surprising that the Department was able to maintain its traditional leading role in the Faculty

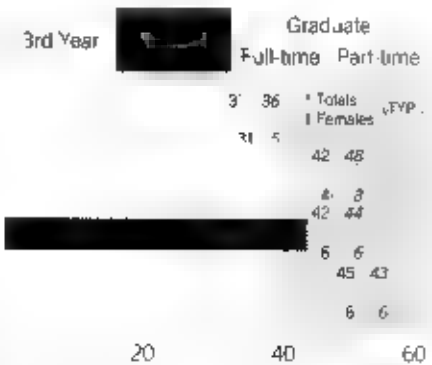


Fig. 4.1 Registration Statistics for Civil Engineering - Fall 1990 with 1991 figures in italics

in terms of total number of post-graduate degree recipients. During 1990 it was responsible for the awarding of 8 graduate degrees and 3 diplomas, including 4 PhD, 3 MSc and 1 MEng degrees, the latter to Mr. James Eric Curren at the 1990 Fall Convocation as the first graduate from Civil Engineering in the Project Management Specialization. Two of the Diploma recipients, Messrs. Anthony G. Howton and Ten C. Huang, became the first graduates from the joint Civil Engineering/Faculty of Management Diploma Programme in Project Management at the same Convocation (see Fig. 4.2). As if to compensate for the less than average production



Plate 4.2 The technical staff of Civil Engineering on the form work for the flat plate model. L to R: Messrs. T.F. Hall, R.H. Pollard, C. Clarke, D.D. Titterton, E.L. Damson, T. Quinn, D.F. Anson, D.E. McCullough, A.B. Sidorsky and F.W. Chenen. 1991

Civil Engineering - 1991

In 1990 during 1991 the Department saw 4 PhD, 6 MSc and 7 MEng degrees and 4 Diplomas awarded to its students. One of the MEng graduates and all 4 diploma students specialized in Project Management.

It was its undergraduate enrolment which continued to be a concern for Civil Engineering which began in 1982 due to the sudden economic downturn. The demand for Civil Engineering graduates and enrolments in Civil Engineering decreased significantly across North America. Although a low point in this enrolment trend appears to have been passed in 1987, the number of students entering the 3rd year Civil Engineering programme continues to lag behind pre-1982 figures. Official 1990 statistics show 84 full-time and



Fig 4.2 Civil Engineering Statistics for 1990 and 1991 (with 1991 figures in italics)

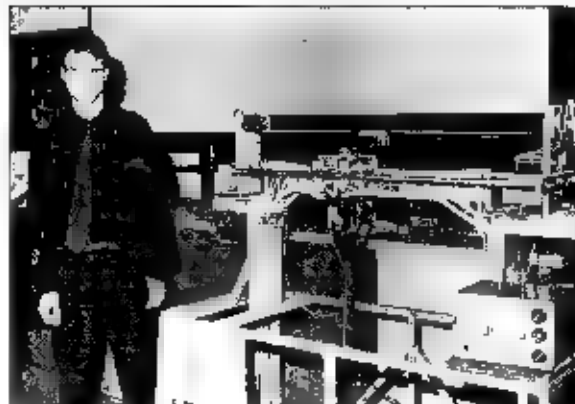


Fig 4.1 Mr. Mark G. Booris, a senior, working on a bridge model.



Fig 4.3 Mr. Neeka Karaywasam accepting his prize from Mr. Paul G. Patterson, P.Eng, senior partner in the sponsoring firm.

Plate 4.1 The 1991 Cohos Evans Partnership Structural Design Competition was held Oct. 18, 1990. It was organized by Prof. A. Ghali who specified a model arch type bridge structure with midspan creaseline requirements. The two \$2,500 winning designs were selected from 7 entries with the winners shown in Plate 4.2.

part-time undergraduates for Civil Engineering with 44 and 40 full-time and 1 and 2 part-time students in the 3rd and 4th year classes respectively. 6 of whom in each class were women (see Fig. 4.1). Next to Surveying Engineering, the Department posted, once again and for the eighth consecutive year, the lowest undergraduate enrolment.

Low enrolments lead to small graduating classes. Thus, in 1990 the Department was responsible for 47 BSc graduates (see Fig. 4.2) as compared with 55, 75, 79 and 19 for Chemical, Electrical, Mechanical

and Surveying Engineering respectively. One of the Civil Engineering graduates, Mr. Richard Wing Shing Hui graduated with *Distinction* and was awarded the APEGGA Gold Medal in Civil Engineering for 1990. The Spring 1991 Civil Engineering graduating class numbered 31 with one member of the class, Shahan Neeka Karaywasam, graduating with *Distinction* and winning the APEGGA Gold Medal (see Plate 2.5).

A highlight of Civil Engineering undergraduate activities is the annual Cohos Evans Partnership Structural Design Competition held during the Fall Session inaugurated in 1985. The competition is open to 3rd and 4th year Canadian Civil Engineering students with a minimum GPA of 3.0 from the previous session. The award, up to \$5,000 in value, is based on the candidate's model structure which he/she must design and construct in accordance with specifications defined by the organizer of the competition. The 1990 contest was under the direction of Dr. W.H. Dinger and was held on October 18, 1990. From the record number (11) of entries, two winning truss designs were chosen for the \$2,500 main prizes, one from Miss Catriona Hickey, a senior, and one from Mr. Simon James Brown, a junior. For the first time, a third prize in the amount of \$500 was awarded



Plate 4.4 Dr. S. Wlaszynski discussing with members of the Transportation Group some final points in airport terminal planning and design research funded by Transport Canada and NSERC. In R. Drs. S. Wlaszynski, J. Hui, M.A. Sergius and J.F. Morrill (Jan. 1992)

to a design by Mr. Robert Joseph Talerico, also a senior and a winner of this competition in 1989. The 1991 competition was held on October 18, 1991 and was organized by Dr. A. Ghali (see Plate 4.3).

In addition to minor curriculum changes, the Department decided to take a leading role in the Faculty and the University in developing interdisciplinary Environmental Engineering Programmes. Fourth year option courses in Environmental Minor and a Diploma Programme involving staff from 4 engineering departments and the departments of Biological Sciences and Geography, are planned. Groundwork for the introduction of an MENG and Diploma programme in Irrigation Engineering, supported financially by the Canadian International Development Agency (CIDA), and spearheaded by Dr. D.H. Manz, continued resulting in departmental approval in late 1991, with programme start-up planned for the Fall of 1992.

Administrative and staff changes during 1990-91 included the appointment of Dr. A.E. McMullen and Prof. B.W. Langan to the newly created positions of Associate Head responsible for undergraduate and graduate student affairs, respectively. Dr. Michele A. Sargious retired at the start of the academic year after serving the Department and the Faculty for over 22 years. His outstanding

contributions were recognized by awarding him Emeritus status effective July 1, 1990. He continues his research as a member of the Transportation Group (see Plate 4.4). His position was filled by appointing in December 1991 Dr. Douglas Hunt, a young transportation specialist.

A second retirement that of Mr. Art Huzar, occurred at the end of the period under review. Art joined the Department as Manager of Laboratories in March 1967 and was appointed to the academic staff in 1969. His valuable service was acknowledged by appointing him Senior Instructor Emeritus effective July 1, 1991. As a member of the Structures Group (see Plate 4.5), he continues his work on masonry and related materials.

A third *profemer*, Dr. H.A. Rod dePaiva, went on sabbatical leave on July 1, 1991 with his retirement set for the summer of 1992. Rod arrived at the Calgary Engineering scene in September 1961 and became a well-known figure of campus life for over 30 years. He held administrative positions at the University, the Faculty and the Departmental level, most recently serving as Director of the Project Management Specialization. The search for his successor was initiated during the fall of 1990 and was successfully completed with the appointment of Mr. Francis T. Hartman effective July 1, 1991 (see Plate 4.6).

In addition to the continuing high graduate student enrolment the Department's research strength is illustrated by several other factors and events. For example, the staff published 90 papers during 1990 including 36 and 48 refereed journal and full length conference proceeding papers, respectively. The Civil Engineers academics were successful in obtaining \$1.1 million in exter-



Plate 4.5 Dr. R.E. Loov and pointing, discussing some of the research results with members of the Structures Group and Dr. D.H. Loov. W.H. Dilger, A.E. McMullen, Mr. A. Huzar and Dr. A. Ghali.

na research funding including a \$91,300 NSERC major equipment grant. An outstanding highlight for the Department, the Faculty and the University was the awarding of a \$50,000 I.W. Kilam Memorial Prize to Dr. W.H. Dilger, a member of the Structures Group (see Plate 2.8). Noteworthy also was Dr. R.E. Loov's highly innovative proposal for a high speed ground transportation system between Edmonton and Calgary to the Nat. Christie Foundation which became a finalist in the competition. Similarly, the Competition for Innovative Ideas in Construction at the Sixth Canadian Construction Congress, Preview 2000, held in Toronto in December 1990 involved two of the Department's entries as finalists.

The international reputation and stature of the staff are underlined by invitations and activities such as those of Drs. A. Ghali, R.C. Joshi and Muzik, already described (see THE SILVER ANNIVERSARY Section in Chapter 1). Others include Dr. S.C. Wirasinghe being appointed Co-Editor in Chief of the Journal of Advanced Transportation effective 1990. Mr. Art Huzar delivering invited lectures at the Asia/Pacific



Plate 4.6 Dr. H.A. Rod dePaiva handing over the emblem of the Project Management Specialization to Mr. Francis T. Hartman with the Secretary to Project Management, Mrs. Kevin Takahara, guiding the procedure.

Conference on Masonry, Singapore March 12-13, 1991 and at the universities of Newcastle and Melbourne. Dr. John Morra being guest lecturer at the School of Mountain Highway Engineering at the Universidad Nacional de San Juan, Argentina September 20-23, 1990. Dr. Nigel Shrive presenting invited lectures in April and May 1990 at the universities of Edinburgh, Manchester and at Imperial College. Dr. A.E. McMullen being invited lecturer in the School of Civil Engineering at Curtin University of Technology in Perth, Western Australia in June 1990.

Even before Faculty status was achieved, engineering research at Calgary was concentrated mainly in two Civil Engineering areas, namely Structures and Materials, with emphasis on concrete. These two areas continue to be the strongest research specializations with the largest groups in the Department. In addition, there is significant activity also in Structural and Solid Mechanics, Water Resources, Geotechnical, Project Management and Transportation. A number of staff are also involved in Biomedical or Environmental Engineering without well-defined groups, or these two areas. During the period under review, the following Civil Engineering research groups, with specific research objectives and membership, were active:

- The Structural Engineering Group including Drs. W.H. Dilger, A. Ghali, Mr. A. Huzar and Drs. R.E.

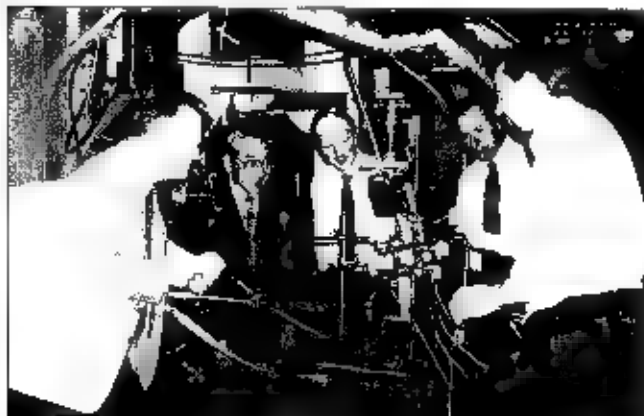


Plate 4.8: Members of the Structural and Solid Mechanics Group witnessing a test on a concrete knee joint. The research is under the direction of Dr. N.G. Shrive. Entire analysis carried out by Mr. Dennis Charnick, RMC MS student in Civil Engineering, who is exploring the functioning of his multidimensional approach and the role of the arched structural ligaments. (L to R: Drs. P.G. Gluckner, C.Y. Chia, N.G. Shrive, R.L. Kuhlemeyer and Mr. D.D. Gault) (1991).

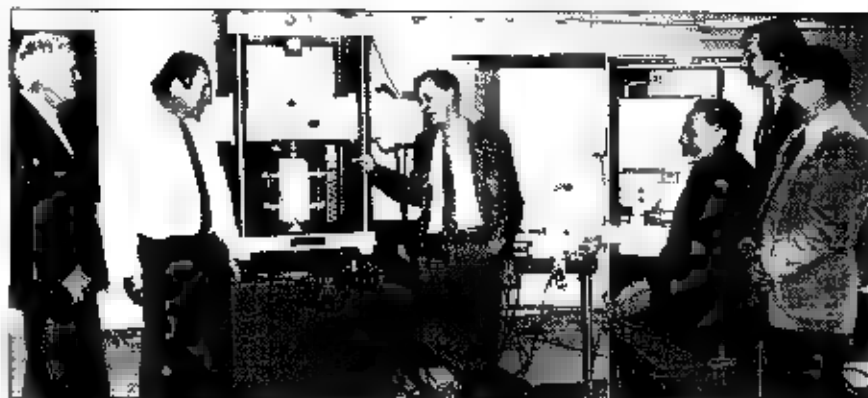


Plate 4.7: The Materials Group in the Concrete Testing laboratory discussing a test about the behaviour of the Tensile Disc. (Compression) technique. (L to R: Drs. M.A. Ward, C.D. Johnston, E. Dilger, Prof. B.W. Langan, and Drs. N.G. Shrive and R.L. Kuhlemeyer) (1991).

ddy and A.E. McMullen (see Plates 4.5 and 4.12) were dealing with the behaviour, strength, serviceability and optimum design of reinforced, prestressed and precast concrete and masonry structures including flat slabs, plate bridges, offshore structures, time-dependent and temperature effects and crack control, matrix and computer analysis of structures including finite element techniques.

- The Materials Engineering Group (see Plates 4.7 and 4.11) consisting of Drs. R.L. Day, J.E. Gilott, M. A. Huzar, Drs. C.D. Johnston, R.C. Joshi, Prof. B.W. Langan and Drs. N.G. Shrive and M.A. Ward were involved in research concerning port and cement-sulphur and asphalt concretes and masonry materials.

their structural and mechanical properties, durability, fracture, quality control, mix design, fibre reinforcement, microstructure and composition, kinetics and mechanisms of reactions, creep, shrinkage and recovery, temperature effects, mortar, unit bond, bonding agents and supplementary cementing materials, particularly fly ash, aggregate

and soils, properties of snow and avalanche conditions, the mechanical response of biological materials and tissues and methods for testing them, synthetic structural materials in biomechanics.

- The Structural and Solid Mechanics Group (see Plate 4.8) including Drs. C.Y. Chia, P.G. Gluckner, R.L. Kuhlemeyer and N.G. Shrive were working on the non-linear and stability response of membranes, inflatable and laminated composite plates and shells, creep stability, finite element modeling of panel and prestressed masonry diaphragm walls under concentrated loads, their fracture and strength.
- The Geotechnical Group, comprising Drs. R.C. Joshi and R.L. Kuhlemeyer, were studying soil-pipe interaction during drying, freeze-thaw cycles of multiple soil layers using finite element models, shallow and deep foundations, earth dams, utilization of lime and fly ash for soil stabilization, long term bearing capacity of foundations and end bearing and friction piles, reduction of lateral pressures by use of fly ash and properties of frozen soils.
- The Project Management Group composed of Dr. H.A.R. dePaiva and Prof. F.T. Hartman (see Plate 4.6) are researching topics in project planning and control, scheduling, procurement and logistics, contracts, risk management, knowledge based systems, technology management and human resources.

- The Transportation Group consisting of Drs J D Hunt, J F Morral, M A Sargous and S C Wrasinghe (see Plate 4.4) are dealing with urban and regional transportation planning, travel demand estimation and forecasting, transit systems modelling and analysis, land use and transportation interaction modelling, traffic flow and engineering, highway and air transport, airport terminal planning and design, urban and transportation economics, parking design and performance of pavements, mountain highway engineering, pedestrian planning
- The Water Resources Engineering Group involving Drs D H Manz and J Muzik (see Plate 4.9) are concerned with open channel hydraulics and hydraulic structures, their physical and mathematical modelling, physical and statistical hydrology, irrigation river and hydro-power engineering and groundwater problems, surface water hydrology, flood prediction and routing, rainfall runoff simulation, geographic information systems, remote sensing, modelling of water conveyance structures and systems
- Biomedical Engineering studies

are carried out by Dr N G Shrive, in cooperation with Dr Cyril B Frank, Dept of Surgery and members of the Biomechanics Group of the Joint Injuries and Arthritis Research Section (see Plates 4.8 and 4.10), on the structural and mechanical behaviour, the transplanting and healing of ligaments and cartilages, their testing using in vivo loading and the relationship between structure and function of these components of the human body

- Environmental Engineering studies are part of the research activities of a number of Civil Engineering academics including Drs R C Joshi and D H Manz. Studies include the supply, quality, treatment and distribution of water, in-stream water quality modelling, waste water collection and treatment, utilization of waste and by-products including fly ash and sul-

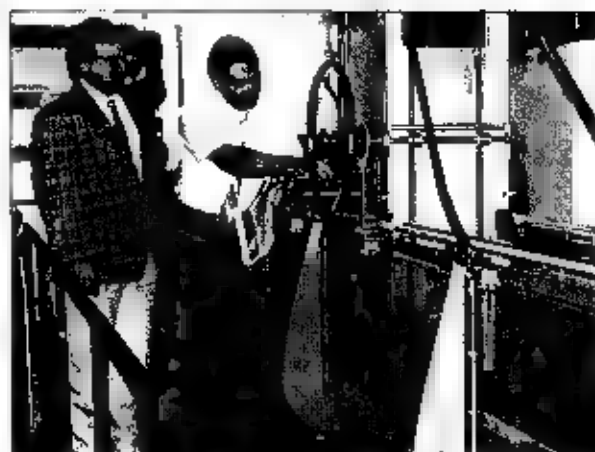


Plate 4.9 Drs D H Manz and J Muzik discussing a research project involving the 1.4 x 7.46 x 20.5 m 2 x 18 x 67.4 hydraulic plume in the Hydrology Laboratory, 1999

fur control of leachate migration from garbage dumpsites and chemical spills by means of thin curtains and liners of stabilized fly ash soil and polymers

In addition to the highlights listed above and in THE SILVER ANNIVERSARY Section of Chapter II, outstanding events, achievements and international activities in Civil Engineering during the period under review include the following:

- Drs J van Muzik and David H Manz were invited to speak at a number of high profiled international water resources, irrigation engineering conferences and symposia including the Int. Symp on Urban Planning and Stormwater Management at Kuala Lumpur, Malaysia May 1990, (Dr Muzik) and the 14th Int Commission on Irrigation and Drainage, ICID Congress, Rio de Janeiro May 1990 (Dr Manz). David Manz's irrigation conveyance system simulation (ICSS) model was successfully applied to improve management and operation of canal systems in the Eastern Irrigation District, near Brooks in Southern Alberta and the main irrigation canals in the Nie Delta. Dr Manz was also involved in water supply and sanitation development programmes in the Philippines and Mexico
- In connection with the introduction of the shear stud reinforcement in Australia and New Zealand, a device invented by Drs A Gha and W H Dilger and used



Plate 4.10 Members of the Biomechanics Group of the Joint Injuries and Arthritis Research Section in the Biomechanics Laboratory being introduced to a newly developed instrument for tissue measurement by Gail Leask and Eric Danson. The laboratory is part of the completion of the 4th floor of the Alberca Heritage Medical Research Building at the Froehills Site of The University of Cape Town. The floor was completed during 1991 from over \$4.8 million raised through Project Motion for research on joint injuries and arthritis. Up to 100 people can work in the laboratory. Mr E L Danson, Mrs G P Leask (back row) Messrs R W McPherson, D D Chimnick, A N Wilson, K W Moore, D A Hart, Drs R C Bray, N G Shrive, R F Zerrulke and C B Frank. Group members Dr N Schachar and Mr F van der Voet were absent. Winter 1992

widely in Europe, the USA and Canada. Prof. Ghai was invited on a lecture tour by the Australian Concrete Institute and its counterpart in New Zealand. He lectured at Sydney, Brisbane, Melbourne, Adelaide, Perth, Wellington and Auckland (May 18-30, 1991) and provided advice on the production of the shear stud. He also served as consultant on a 'STJDRAIL' experimental research programme at Curtin University of Technology in Perth, Western Australia.

- Dr. Robert L. Day and Mr. Art Huizer visited La Paz, Bolivia, in April, 1991 in connection with a collaborative research project with the Bolivian Chemical Industry, the Ministry of Housing and the Universidad Mayor de San Andrés. The project, which was initiated on Nov. 1, 1988 and terminated on Dec. 31, 1992, was funded by the International Development Research Centre (IDRC), Ottawa, in the amount of \$273,000 of which \$72,280 was available to the Calgary staff.



Plate 4-2: View of the East half of the Structural Laboratory with a 6 m x 9 m full scale segment of a flat plate concrete floor system ready for concrete pouring. Construction of this test facility and the programme were made possible through special NSERC grants to Drs. W.H. Dinger and A. Ghai, a \$91,700 major equipment grant and a \$40,000 annual infrastructure grant (1991).

for research and travel. It was aimed at the development of low cost building materials, including masonry units and stucco mortar in which Portland cement is replaced by locally available pozzolana (volcanic ash) and lime. The project as well as a parallel study in Guatemala were under the direction of Dr. Day with Mr. Huizer providing masonry/structural expertise as consultant.

- As a follow up to the very successful IDRC funded Sri Lanka intercity travel demand estimation and forecasting study, carried out by Drs. S.C. Wirasinghe and J.R. Morral in cooperation with colleagues at the University of Moratuwa, Sri Lanka, they visited Sri Lanka in August 1990 to present a draft report on transportation planning for small towns in that country. They obtained further data for their report and discussed and laid the ground work for a proposal for a 5 year research, development project aimed at transportation planning for small towns and rural areas in Sri Lanka and the training of technical personnel including graduate students. The proposal was submitted to CIDA for funding in the Fall of 1991.
- Based on the work his MSc student J.B. Jamieson did for his degree requirements on in-situ tensile strength of snow pack layers and with the collaboration of M. Wegele, Helicopter Skiing, Dr.



Plate 4-1: Dr. Jack E. Gillott and his research team discussing a phase composition analysis of construction materials using the X-Ray Diffraction apparatus. L to R: Mr. Terence Quinn, Drs. E. Gillott, H. Wang and Mrs. E. Grabowski (1991).

C.D. Johnston submitted a research proposal and was awarded a 3 year NSERC University Industry Cooperative Research grant, effective Jan. 1990 in the amount of \$133,700 with \$154,850 in cash and kind as the industry contribution. The project for which Bruce Jamieson is Research Associate and Mr. P. Schaerer of the National Research Council's Avalanche Research Centre in Vancouver the Project Liaison Officer, dealt with snow slope stability evaluation and avalanche hazard forecasting in back country skiing.

- Increasing international recognition of the biomedical engineering work of Drs. N.G. Shrive and C.B. Frank, carried out in collaboration with members of the Biomechanics Group (see Plates 4-8 and 4-10) was underlined by an invitation from Osteotech Inc., USA, for the researchers to test tissues using their newly developed, unique apparatus and technique, and to deliver an invited paper on some results of their studies at the 1st World Congress on Biomechanics, held in San Diego, Aug. 30 - Sept. 4, 1990. Their work is supported through external research funding exceeding \$0.25 million annually from NSERC, the Medical Research Council, MRC, the Arthritis Society, the Alberta Children's Hospital Foundation, Osteotech Inc. and other private and governmental sources.





Plate H — South end of Engineering Courtyard, View towards W Jan. 1992

A HEAD START

The *blueprint* for the Engineering Centre contained in the Govier Report called for completion of the Civil Engineering Wing by September 1963. With a delay of approximately one year, this first stage of the Complex was ready for occupancy in August 1964. The Chemical, Mechanical and Electrical Engineering Wings were completed in 1966, 1967 and 1968, respectively. Thus Civil Engineering enjoyed a 2-4 year *head start* in terms of having its own permanent office and laboratory space.

A second and perhaps even more important factor contributing to Civil Engineering's *early lead* was its manpower advantage. We saw in Chapter I that the academic staff initiating the first year engineering programme at the SAIT Campus in September 1957 consisted of Messrs. H.R. McArthur, Associate Prof. of Appl. Mechanics, and W.H. Striwell, Assistant Prof. of Civil Engineering (see Plate 2-17). They were responsible for the engineering courses of the curriculum which, as most engineering programmes of the day, had a heavy Civil/Mechanical flavour for freshmen and sophomores with only a 2nd year Electrical Engineering circuitry course and two chemistry courses deviating from that traditional subject matter. It was therefore not surprising that in the Fall of 1960 a civil engineer, P.G. Glockner, and two mechanical engineers (A.G. Dodge and R.H.B. Hebbert) were transferred from the

Edmonton campus to Calgary to help with the start up of the second year programme (see Plate 2-21).

The strength of the Calgary Civil Engineering staff complement was further increased by hiring a fresh Civil Engineering PhD graduate, Dr. H.A.R. (Rod) de Paiva, effective Sept. 1, 1961 (see Plate 2-25). When Peter Glockner went on study leave in the Fall of 1962, Prof. Walter L. Begg from Civil Engineering in Edmonton was transferred to Calgary for the 1962-63 academic year.

Engineering at Calgary and the Civil Engineering cause, in particular, received a real shot in the arm when Dr. Adam M. Neville, Professor of Civil Engineering at Saskatoon specializing in concrete materials, was selected as Chairman of the newly created Division of Engineering at Calgary effective July 1, 1963 (see Plates 2-28 and 4-18). The arrival of Adam Neville signalled the start of a new era and a period of unprecedented growth in Engineering and Civil Engineering at Calgary. To start with, he brought with him a technician, Mr. W.H. (Bill) Tingley and 4 graduate students (see Plate 2-29). He hired a research assistant, Mr. Donald J. Martin, and a new civil engineering staff member, Mr. Robert



R.H. Mills



Susan Jamniczky



A. Huizer

Plate 4-13 The initial Civil Engineering administrative team, 1967

E. Loov (see Plate 2-32), the latter as replacement for Prof. H.R. McArthur who went on leave effective July 1, 1963. By start of the Fall '63 classes, he had established an MSc programme in concrete materials and structures with 5 full-time graduate students (see Fig. 4-3) and 19 special students, local practicing engineers, enrolled in the first 3 graduate courses in Engineering at Calgary dealing with properties of concrete, reinforced concrete (R/C) members and prestressed concrete (P/C) structures, respectively. Thus, in addition to gaining divisional status, Engineering at Calgary was suddenly transformed into a dynamic school of undergraduate and graduate education and research, shedding its 6-year-old *junior college cloak*. Adam Neville found time to bring to life the dormant Engineering Building project getting its construction under way by November 1963 (see Plate 4-14).

During his first year, while housed in the Science and Engineering Building (now Science A), the new Division Chairman established a Concrete Research Laboratory in the basement of the building. Much of his time and that of the academic staff was spent on planning the move into the First Engineering Building, the E-Block. He also concentrated on recruitment of academic and support staff and graduate students. On Jan. 2, 1964, he hired Mrs. Eva Boyd who was to hold a variety of positions in the Faculty, including Civil Engineering Departmental Secretary and Dean's Secretary (see Plate 2-47). After

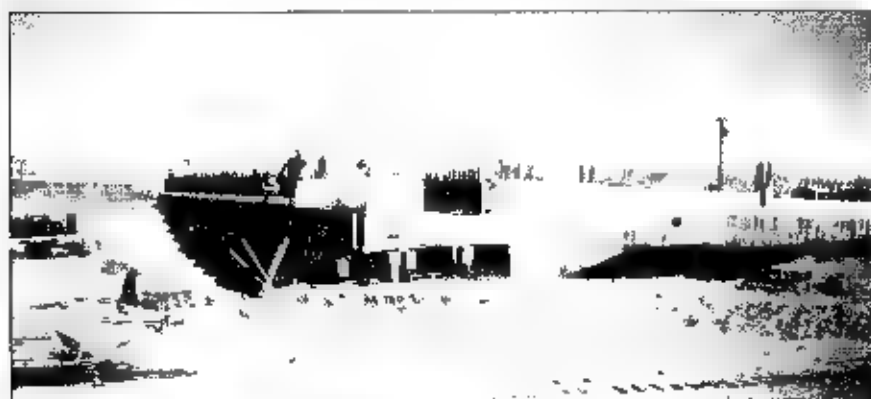


Plate 4-14 The concrete work for the basement of the Civil Engineering Wing completed, view towards the E. December 1963/January 1964

Civil Engineering 1966-1979

Donald Martin became a graduate student, he employed two new research assistants, Miss S. M. Judith Porter and Mrs. Maria Fogaras, in May and July 1964, respectively (see Plate 2-32) and a second technician, Mr. E. Martinuk, also in May.

Despite the increase in available Civil Engineering academic staff due to the return of Dr. P. G. Glockner from his study leave, the resignation of Prof. Walter H. Striwe effective Sept. 30, 1964, and the heavy teaching load required the appointment of Messrs. H. M. McCleister and G. A. Hitchens as Sessional Lecturers in Civil Engineering for 1964-65. The increased teaching load resulted from large 1st and 2nd year enrollments and 7 graduate courses offered to 13 full-time graduate (see Fig. 4.3) and 59 special students, including 7 new MSc registrants, Messrs. A. K. Aston-Ekrem, H. A. Guger, S. G. Hutton, Gibson, Ch. S. Kwe, D. Martin, K. Nasser, A. S. E. Rutledge, and the first PhD student in Engineering at Calgary, Mr. Muthian Gunasekaran, with a programme specifically approved for him. The graduate course offerings included 4 new courses on intermediate and advanced structural analysis, theory of plates and theory of shells, respectively. The highest enrollment was in the 1963-64 session, the year and the Fall 64 session.



1. *Phragmites* (1990)

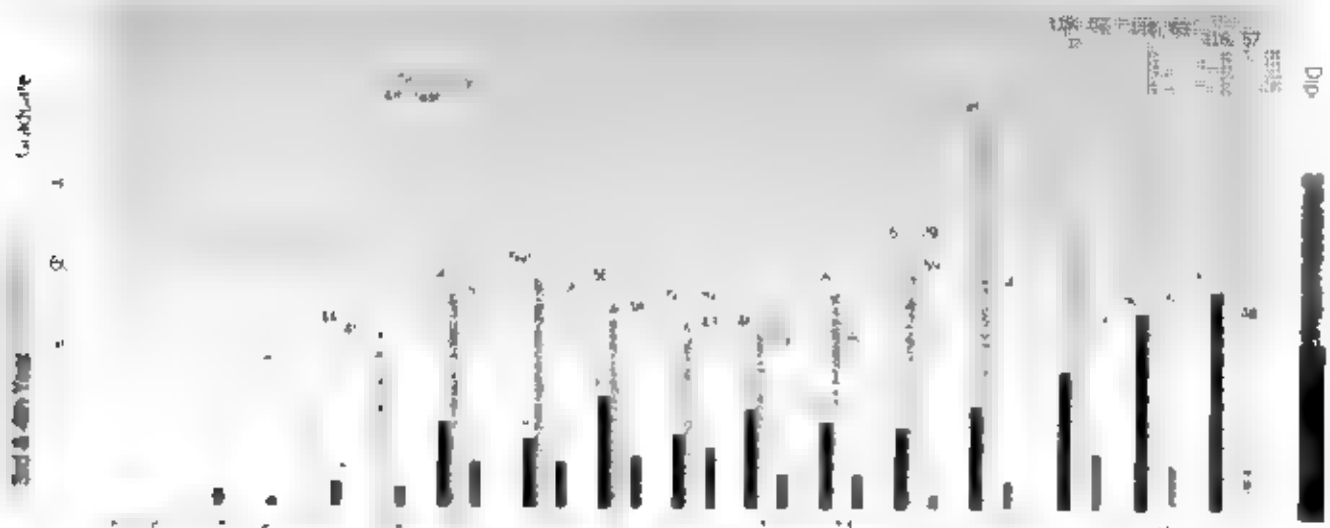
the opening of the First Eng
on the Calgary
is in November 1964 see

At the 1965 Convocation in 1965 the first 4 engineering MSc students (see Plate 2.29) received their degrees. The 5th degree bearer, Mr. R. M. ...

During the spring and summer of 1965, Adam Neville as Dean of the Faculty of Engineering was in charge of the faculty. A Civil Engineering department was established in 1965. Drs. B. B. Hope and M. A. Ward

Assist. Prof., effective Sept. 1 and
Mr. D. W. Langan, Research Assis-
tant, as of Nov. 22, 1965 (see Plate
2-19). He also appointed Mr. J. A.
Webber as Sessional Instructor in
Civil Engineering for 1965-66.

Graduate enrolment continued to grow at an ever increasing rate. In the Fall of 1965 there were 21 full-time graduate students active on Civil Engineering research projects including 3 PhD (Messrs. K. S. Gopakrishnan, M. Gunasekaran and M. A. Sheikh) and 18 MSc students. The latter group containing such new registrants as Messrs. D. Cook, N. K. Goodrich, A. Guruswami,



E.L. Jessop (see Plate 4.18), P. Jha, G.A. Johnson, S.E. Nelson, A.K. Saxena and K.K. Verma. These students and the majority of the 64 specialist students in engineering were registered in one or more of the 10 Civil Engineering graduate courses offered that year, including 3 new courses on computer analysis of structures, the design of R/C structures and the analysis and design of folded plate domes, and shells, respectively.

Secretaries and technicians hired during the winter and spring of 1966 when the core Civil Engineering staff after July 1 of that year included Mrs. C.J. Eggerslev and Miss K.G. Kawaguchi (see Plate 2.47) and Messrs. T.F. Nall and J. Widning (see Plate 4.16). After working with Dr. Neville's group for 2 years, Judith Purser resigned and left on April 30. The last group of civil engineering academics recruited by Adam Neville as Dean included Dr. D.H. Clyde, Assoc. Prof. effective July 1, 1966, and Mr. R.H. Mills, Assoc. Prof. and Dr. W.H. Diger, Professional Associate effective September 1, 1966 (see Plate 2.49).

At the 1966 Spring Convocation, Mr. Stanley George Hutton, supervised by R.E. Loo, was again the only graduand from Engineering, receiving his MSc degree.

Departments in the Faculty of Engineering at The U of C officially came into being on July 1, 1966, a date which might easily have been missed since it brought about no visible change in the day-to-day operation of the Faculty and the activities in E-Block. A further 2 months elapsed before the C and D-Blocks

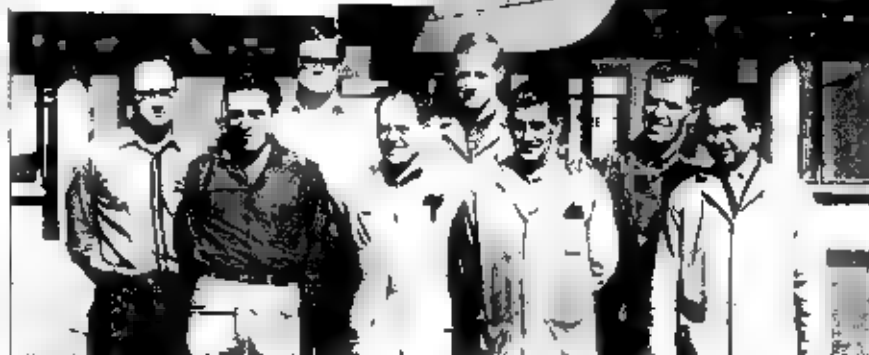


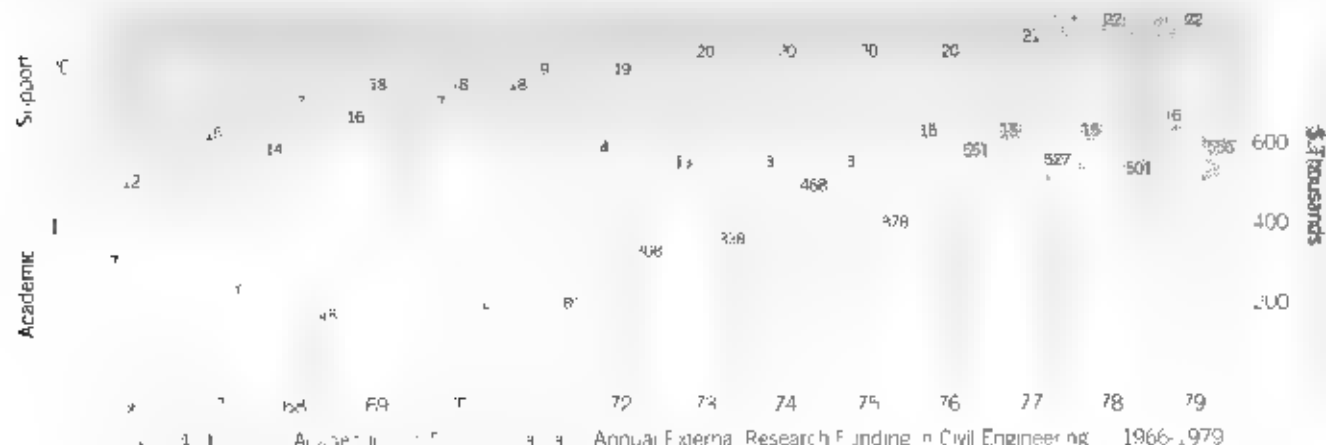
Fig. 4.4. Faculty of Engineering staff in 1966. From left to right: Dr. W.H. Diger, Dr. D.H. Clyde, Dr. R.H. Mills, Dr. T.F. Nall, Dr. J. Widning, Dr. C.J. Eggerslev, and Miss K.G. Kawaguchi.

were ready for occupancy and the Chemical and Mechanical Engineering academic and support staff moved into the Chemical Engineering Wing. The distinction between Faculty and Civil Engineering activities also became somewhat more apparent after the Dean and his staff moved into their new quarters in the C-Block. Finally, after 2 years, the Department was able to take possession of a substantial portion of its space with only Electrical Engineering continuing to reside in E-Block. Experimental research facilities could now be expanded.

The Department of Civil Engineering was born in its own building, a privilege which none of the other departments enjoyed. Also, on July 1, 1966, Civil Engineering at The U of C represented an operation with 8 academic staff, 2 research assistants, 4 technical and 4 secretarial staff, and more than 24 graduate

students, both MSc and PhD registrants. Two further staff members were scheduled to start on September 1, 1966 (see Fig. 4.4). The Dean and Assistant Dean of the Faculty were from civil engineering and the academic staff had external research funding totalling \$111,000, including a \$40,000 NRC major equipment grant. All graduate students who had completed the degree requirements prior to July 1, 1966, 6 MSc graduands in all, had been involved in civil engineering research projects. When these statistics are compared with corresponding figures, if any, for the other 3 Departments, Civil Engineering's head start becomes quite apparent, an advantage which was to provide part of the momentum required to maintain a leading role in the Faculty during the next dozen or more years.

For the first 6 years, from July 1966 to July 1972, the Department grew very rapidly, as expected, to a size ex-



experienced a relatively high rate of staff turnover and changes in administration. To start with, despite its head start, Civ. Engineering was without a Head on July 1, 1966. During the first 6 months of its existence it operated under the executive authority of Dean A.M. Nevie with Dr. Brian B. Hope serving as Budget Officer and Trust Holder, Mrs. Eva Boyd as Departmental Secretary and D. M.A. Ward as Supervisor of CE Laboratories, a position he held until the Fall of 1968.

Fall 1966 graduate student enrolment reached 34, including 8 PhD and 26 MSc students. There were also 128 special students enrolled in one or more of the 10 graduate courses offered that year. Three new courses dealing with engineering applications of elastcity, plasticity and stability theory, respectively, were introduced and approved. Two of the civil engineering MSc students, A.K. Aslan Ekrem and H.A. Guger, received their degrees at the 1966 Fall Convocation.

The administration of the Department was stabilized with the appointment of R.H. Mills as inaugural Head of Civ. Engineering effective Jan. 1, 1967. Mrs. Boyd continued as Departmental Secretary until March 1, 1967 when Miss Susan Jamniczky was hired to succeed her. Eva transferred to the Dean's office in May 1967. At the end of March, Mr. Are Huijzer arrived from Melbourne to become Manager of Laboratories effective April 1, 1967 (see Plate 4.13). The chairman of the Building Committee, Dr. D.H. Clyde reported

at the Departmental Council Meeting of March 9, 1967 that the Committee had completed its work and had submitted its recommendations to the Dean for incorporation into his *Proposal for Stage Development of the Engineering Complex*, dated March 7, 1967. The Department and the Faculty were optimistic that the proposed Civ. Engineering Extension would be approved and constructed to be ready for occupancy by 1969. At the 1967 Spring Convocation 4 more civil engineering graduate students, Dr. Cook, A. Guruswami, E. L. Jessop, P.C. Jha, received their MSc degrees.

On July 1, 1967 Adam Nevie went on sabbatical leave and Rüdiger Pawa became Acting Dean of a year. Prof. Edgar Lightfoot from Oxford University arrived to spend one year in the Department as Visiting Professor. Dr. Ryszard Kowalczyk joined the Department as Research Associate in Feb. 1968. New academic staff hired during the spring included Drs. Y.K. Chering, Assoc. Prof., A.E. McMullen and C.D. Johnston, Asst. Prof., effective July 1, Aug. 14 and Sept. 18, 1967 respectively (see Plate 4.17). Water Diggers' appointment was changed to Asst. Prof. as of Sept. 1, 1967. It was on his recommendation that Mr. Erich L. Damsor from the Technical University of Stuttgart was hired and



Y.K. Chering



C.D. Johnston



A.E. McMullen

Plate 4.16 New Civil Engineering Academic Staff, 1967

joined the technical staff at the beginning of September.

Brian Hope resigned after being in Calgary for 2 years and left at the end of August. At the same time Bob Loov went on a 2 year study leave to Cambridge. Eugene Marinuk quit in August to be replaced by a young technician, Mr. E. Westerbeek, who was to remain in the Department for 13 years.



The third year of the new engineering curriculum was implemented in September 1967 with the first Civ. En-

Plate 4.19 The first PhD graduate in Engineering, Rüdiger Pawa, Calgary, M.A.Sc., 1967. Engineering, Fall Convocation 1967

gineering 3rd year class numbering 23. In offering the junior courses for the first time, professionals from downtown had to be brought in as special part-time sessional instructors and lecturers, a stop-gap measure the Department was forced to use during the first few years of its operation. Graduate enrolment that Fall increased to 44, including 13 full-time PhD and 17 full-time MSc students.

The space shortage was relieved somewhat when the Mechanical Engineering Wing was completed in August 1967 and about one of the Electrical Engineering academic staff and their secretaries moved into B Block. The Department continued to house Electrical Engineering technicians, graduate students and research laboratories. However, a Structural Models laboratory could finally be created. The heavy structures research continued to be ac-



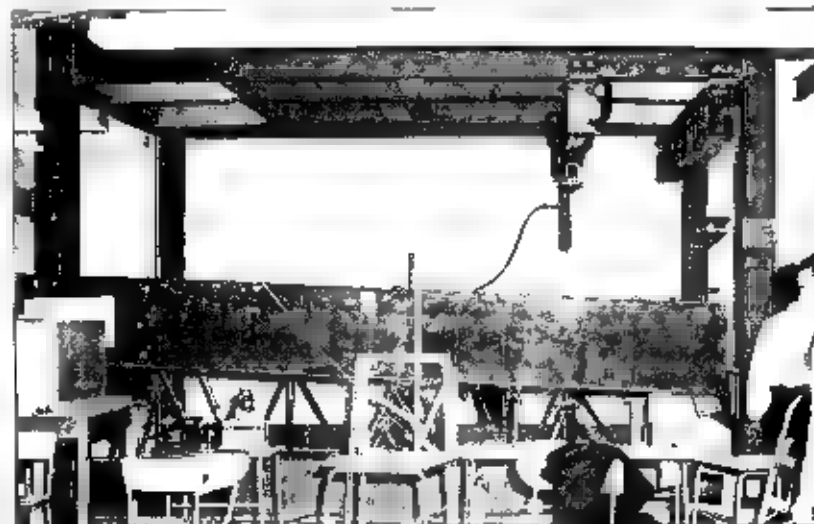
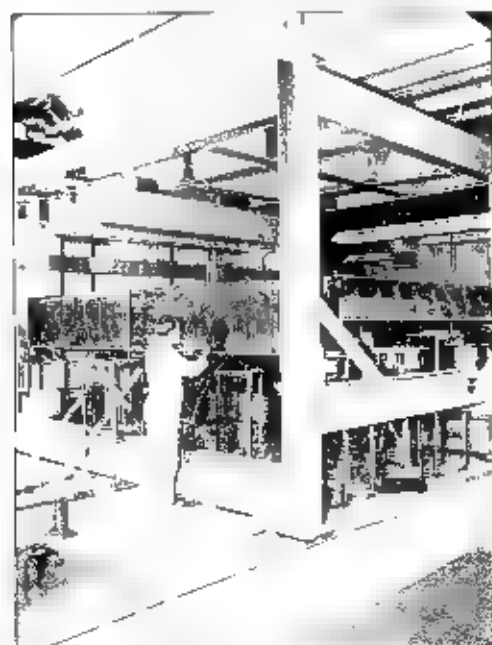
Plate 4.19 First Civil Engineering Academic Staff Supervisors, Dr. M.A. Ward, and Dr. A.M. Nevie

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The Cambridge Merton Group
 is a group of people who are
 devoted to the study of
 the history of the
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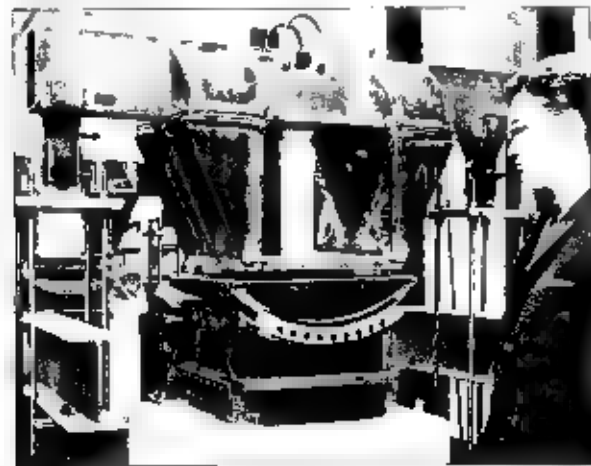
The Acting Secretary Staff notified
the Acting Chief Mr. John McLean on
December 19th. The resignation of Mrs.
Suzanne Devine was announced at the

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From left to right: Dr. R. E. Loov, Dr. A. E. M. Mulen, Dr. J. E. Gockner, Dr. J. E. Gockner, Dr. J. E. Gockner, Dr. J. E. Gockner, Dr. J. E. Gockner.

The Fall '69 graduate enrolment rose to 53, including 20 PhD, 19 MSc and 14 MEng students. Five new graduate students in Transportation and General Engineering were enrolled in the department in November. After the Faculty of Graduate Studies eliminated the foreign language requirement for PhD candidates, the Department followed suit at a meeting of May 1970. The incoming graduate program was reviewed and was a credit in 3 years by the Accreditation Board of the Canadian Council of Professional Engineers, CCPE. On Feb. 5, 1970 the ever NRC visiting team Drs. Art C. Heidebrecht and John B. Kennedy from McMaster University and the University of Windsor respectively visited the Department. The downturn in the economy in the Spring of 1970 resulted in a tight job market for the graduates, both undergraduate and graduate degree holders.



The machine shown in the photograph is a universal testing machine, capable of testing materials under tension and compression. It features a large frame and a central testing area with a specimen being tested. The machine is labeled with 'heads, capable of testing materials under tension and compression' and 'the machine was modified in 1970'.

Working drawings for the New Civil Engineering Building were completed by the consultant T. Lamb, McManus and Associates and the Department was optimistic that funds would be received to start construction.

At the 1970 Spring Convocation there was, once again, a good crop of civil engineering graduate degree recipients, including 1 PhD and 1 MSc student. An identical number of PhD and MSc graduates from the Department appeared at the Fall Convocation. In addition, in November 1970, the first MEng graduates were awarded. The first degree recipient, Mr. J. E. Gockner, was a graduate of the Department of Civil Engineering. The first MEng graduate, Mr. J. E. Gockner, was a graduate of the Department of Civil Engineering. The first MEng graduate, Mr. J. E. Gockner, was a graduate of the Department of Civil Engineering.

her cause, the first graduate student out of a class of 18 graduated in November, a major achievement at the time. The first graduate student, Mr. J. E. Gockner, was a graduate of the Department of Civil Engineering.

The first graduate student, Mr. J. E. Gockner, was a graduate of the Department of Civil Engineering. The first graduate student, Mr. J. E. Gockner, was a graduate of the Department of Civil Engineering.

The first graduate student, Mr. J. E. Gockner, was a graduate of the Department of Civil Engineering. The first graduate student, Mr. J. E. Gockner, was a graduate of the Department of Civil Engineering.

The academic staff offered 18 graduate courses, 6 of which were new. At the meeting of Council of the Faculty of Graduate Studies on Nov. 1970, formal approval for a PhD program in Solid Mechanics was given to the Department. In addition, a program for the studies in Composite Materials was approved. Materials program.

On July 1, 1970, Drs. R. E. Loov and A. E. M. Mulen were appointed for a 3 year period to the part-time positions of Assistant to the Vice President for Academic Resources/Services and Assistant Dean, respectively. Dr. A. Ghafeleff for Paris on a sabbatical year after being selected by NRC as a participant in the Cultural Exchange Programme between Canada and France. The lecturer, Dr. J. E. Gockner, was appointed by Mr. Brian W. Gockner, going on a 1 year sabbatical, effective Sept. 1, 1970, to complete his MSc degree. Dr. J. E. Gockner, who was hired as Assoc. Prof. who arrived on Aug. 1, 1970. The transportation area was strengthened by the appointment of Dr. John F. Morra, effective Jan. 1, 1971. Dr. Plate 424, who, with Michele Sergous, formally established the Transportation Group and developed a graduate program in this specialization. There were also several instructors, part-time and full-time, and 6 students. A graduate program was given to the Department and the address was given.

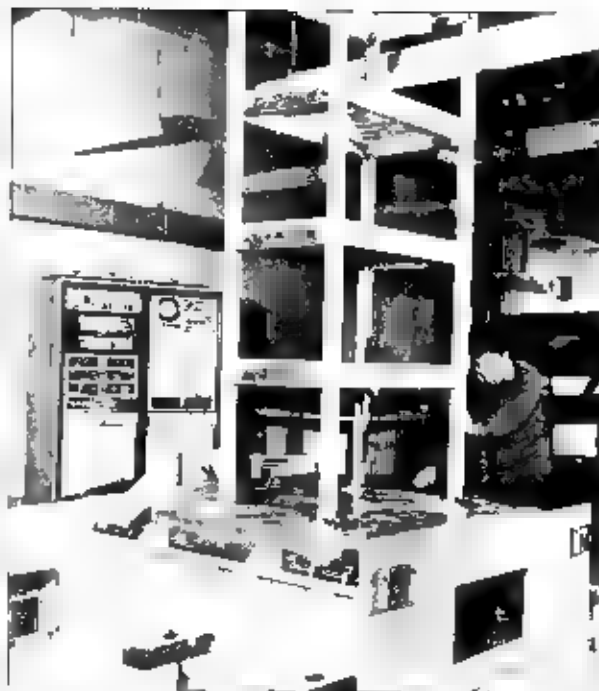
Some other noteworthy events of 1970-71 for Civil Engineering include the participation of David J. McManus and P. G. Gockner in the Los Angeles test at DRES, even though they failed on July 23, 1970, in which they studied the dynamic response of a spherical sandwich radome subjected to blast loadings.

F. J. contributed to the concrete technology of the concrete industry. Mr. F. J. was frequently recognized by the elected House of Representatives as a Member of the Alberta Ready Mixed Concrete Association at their annual convention on March 26, 1971 at the Banff Springs Hotel.

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in the late 1960s, great credit to the Puerto Rican Machine Project. The Assistant Professor's work was in agreement with the view to organize the staff strength and carry out investigations. Mike Ward and Bruce Linton were also involved. The expert panel on the Shell Structures Group was brought to us by Drs. Gha. Cheung and D'Iger being asked to carry out a complete finite element structural analysis and design check of the 1 million barrel underwater storage tank for the Ekotisk Offshore in the North Sea (see Plate 4.30). Some 14 months after the successful CANCAM Congress (see Plate 2.69) the Department hosted a major international meeting the ASS Conference on Shell Structures (see Plate 4.29).

Professor Pava's appointment as a Professor of Services was confirmed during the Spring of 1972 and Dr. Michael A. Ward was appointed for a 3 year period as third Head of Civil Engineering. He was a rising star with his leave from Oxford (see Plate 4.27) and a short time later the Professor of Applied Mechanics brought a 12 year period of stability and development growth to Civil



Mike Ward



Bruce Linton



Peter Glockner



Dr. Michael A. Ward

Engineering. It was during which Mike Ward provided leadership and ingenuity in the Department's development (see Plate 4.28). The only change in administrative personnel during the term of office occurred in 1971 when John McEwen resigned his position and left the Department. Basil St. John Marshall became the fifth Departmental Secretary on Oct. 8, serving the Department in that position for over 14 years until her retirement on Jan. 31, 1989.

The new Head turned his attention to the staff of the Department. The Department was in desperate need of a new Head and he expected the course of a Head of Civil Engineering was entered for a 12 year period by Dr. D.G. Huter. He was a member of the Department.

Dr. Michael A. Ward was appointed as Professor of Civil Engineering in 1973. Mike Ward was the right person so that he could inform the Departmental Council on Apr. 4th that Dr. Michael A. Ward will join the Department as Assoc. Prof. of Applied Mechanics (see Plate 4.28). He also informed the Council that he had been charged with the responsibility of the Department. Dr. Ward was appointed as Assoc. Prof. of Applied Mechanics on Oct. 1, 1973. The teaching manpower of the Department was further increased by the return of Drs. McMullen and Loo who had served out the respective administrative appointments on June

30, 1973. On the negative side of the balance sheet was Dr. Loo's departure. He was succeeded by Bob Loo's successor in the Vice President's office. The period July 1973 to July 1975.

When Ka. Cheung resigned and left in May 1974, Dr. Ward quickly reacted and was able to hire an internationally known expert in computational mechanics, Prof. Bruce M. Irons, effective Sept. 1, 1974 (see Plate 4.28). He was also successful in persuading a bright young engineer, Dr. Nigel G. Shrive, whom he had met during his sabbatical at Oxford three years earlier, to join the structural research group on Nov. 27 as Principal Researcher. Seven months later on July 1, 1975, he appointed Nigel as Asst. Prof. Part-time, an appointment which was changed to a full-time status on April 1, 1976 (see Plate 4.28). These appointments were facilitated in part by the departure of Mr. Jim Bloor, on June 30, 1975, and Grant Ross's decision to join Environmental Design effective Jan. 1, 1976. As we saw in Chapter 3, Art McMullen was called back to duty in the Department on Sept. 1, 1974 to look after the office of Head of Common Curriculum. Then on Dec. 20th, after Dr. D.G. Huter left for New Zealand, he became Acting Dean until June 30, 1975.

On July 1, 1976, Peter Glockner accepted an invitation to become Head of Mechanical Engineering and moved over into that department under the condition that he has the option to return to Civil Engineering at the conclusion of his term of office. A month later Dr. S.C. Chan was named to the Transportation Group. A former PhD student in the Department, Dr. Emyrn L. Jessop



Plate 4.29 Dr. A.M. Loo and Dr. H.G. Glockner at the ASS Conference, University of Delhi, India, during the week of June 13-19, 1973. Prof. Huter was also present.

As to the details of the ASS Conference, see the report of the ASS Conference, July 3-6, 1973, and the chairmanship of Dr. Glockner. The theme of the conference was Shell Structures and Climatic Influences.

Chapter vi and Appendix x His appointment as Head was renewed in July 1975 for a 5 year term.

In addition to the curriculum changes noted above there were a number of other developments during the 1971-79 period. After the introduction of Marshall Gys. an MSc programme in Water Resources was developed and approved. At the same time a PhD programme in Transportation was established with Boris Travitski as first student who graduated at the 1974 Fall Convocation. Under the supervision of Resources the Environmental and Planning CRE Programme. The first biomechanical course introduction to Biomechanics ENC 62164 was offered by Nigel Shrive during the 1966-67 session. Starting in 1977 the new surveying engineering undergraduate programme was being developed. Continuing the establishment of the Division of Surveying Engineering on July 1, 1979 and inauguration of the 4th year Surveying Engineering program in September 1980. See Chapters I and VI and Appendix J. A 4th year programme was undertaken in correlation with the Faculty's curriculum review completed in 1977. As a result additional flex-



Figure 1.1: A person in a white lab coat is working with a large, dark, circular object, possibly a piece of equipment or a large container, in a laboratory or industrial setting.

ibility and specialization was introduced into the civil engineering curriculum by 1981. Instruction in Construction Management precursor to the Project Management Specialization developed during the 1980s. It is beginnings with Bob Chow's 2 day short course in Critical Path Methods (CPM) offered between 1974-78 after several times a

In addition to the activities and achievements just discussed above a few of the many outstanding projects and achievements of Civil Engineering during the first 7 years of McEwen's term in office are in the following:

- The Clay Minerals Society Meeting was held October 7-11, 1973. Banff organized under the chairmanship of Dr. Jack G. Iott. As I to underline the success of this event and the international stature of its organizer, Jack G. Iott was invited by the Ministry of Higher and Special Education of the USSR on a 2 week visit and lecture series at Moscow State University June 1-14, 1974.



Figure 1.2: A person in a white lab coat is working with a large, dark, circular object, possibly a piece of equipment or a large container, in a laboratory or industrial setting.

year before. The first 1 day and 2 day short courses in Critical Path Methods suggested the possibility of a construction management specialization at the Departmental Council meeting of March 8, 1979. See Appendix F.

The Department's graduate programme was reviewed in 1966-67 by a Committee of the Faculty of Graduate Studies involving 3 external reviewers. The Committee's final report was very complimentary judging the programme's staff and students. The area of Structures and Materials to be among the top 3 or 4 in Canada, and rating the Structures area to be excellent on an international scale.

- Work on the fundamental engineering properties of sulphur, its use as a structural and insulating material and on sulphur concrete was begun in 1972-73 with funding through a NRC capital equipment grant of a \$24,000 PRA (Project Related Assistance to Industry) grant with 8 members of the Department. Drs. D. Ger, Gamble, Gha, G. Iott, Jordaan, Loo, and Ward, and Mr. Le Gar participating. After Nov. 1974 Dr. Shrive was Principal Researcher on the project. Additional funding (\$2,000) was obtained from the Sulphur Development Institute of

+ 3d Wa t a minute. Howard! That is too heavy for one man to lift! Mr Johns
 is *one of the curved beams* tested by PhD candidate Mr H F S.

- Returning from his 1974-76 sabbatical year at Imperial College where he worked with Dr. John Murray he developed a new system for the static mechanics and the application of probability and systems theory in Civil Engineering. Dr. Murray established the Informal Systems Group in 1977 consisting of Drs. Murray, S.C. Wrasinghe and himself. The first undergraduate and graduate courses in Systems Engineering were taught by an informal group in 1982. He organized with Chan Wrasinghe's help the *First Canadian Seminar on Systems Theory* for the 1st Engineer and the 1st Civil Engineer in 1979.
- Dr. John F. Murray was awarded

- For his lifetime's work on concrete, the rate was a 10% increase. In recognition of his fibre reinforced concrete work, C.D. Johnson was awarded the American Concrete Institute's ACI prestigious Leonard G. Wason Medal for Materials Research in April 1976. The award was based on two papers presented at an international symposium on fibre reinforced concrete, which were published in *Specialty Publications ACI Special Publication on Fibre Reinforced Concrete SP-44* in May 1974. Dr.

[illegible]

- A second major materials/structures research project was initiated in 1973 by A. Huzar and M.A. Ward in masonry with a modest (\$7,500) grant from the Alberta Masonry Institute (AMI). This work was accelerated and expanded when in the Fall of 1973, AMI was awarded a 3 year \$120,000 grant under NRC's Industrial Research Assistance Programme (RAP) for a field and laboratory study of masonry mortars. Principal re-

In June 1974 The IRAP grant was extended to the end of 1977. One of the highlights of this first period of masonry research at The U of C was the *First Canadian Masonry Symposium* June 7-10, 1976, held at The U of C and sponsored by the University, the Canadian Society for Civil Engineering, CSCE, the National Research Council, NRC and the Canadian Masonry Contractors Association, CMCA. Evelyn Jessop was chairman of the Organizing Committee with Harry Morstead, Executive Director of AMI and Mike Ward members of the Committee.

Research Activity in masonry swung into high gear with the creation on April 1, 1979 of the Canadian Centre for Research and Development in Masonry, at The J of C, funded by the Department of Industry, Trade and Commerce through a 3 year \$1.0 million seed grant. With the establishment of the Centre, 6 years of work by the Masonry Industry and the Department was brought to fruition. Dr. E.L. Jessop was named Executive Director and Drs. H.A.R. de Paiva and M.A. Ward from the University



No. 284

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and Mr. Harry Morstead the industry spearhead in this activity were appointed inaugural members of the Centre's Board of Directors. Graduate study in masonry which had been initiated in Sept. 1976 with the appointment of Emlyn Jessop as Assoc. Prof. (part time in Civil Engineering, was expanded after April 1979. By 1985 3 Msc and 2 PhD degrees were awarded to civil engineering students specializing in this field. The icing on the cake for the successful launching of the Centre was the \$57,200 capital equipment grant awarded to Mike Ward in the Spring of 1979 by the Clay Brick Assn. of Canada which was matched by the Province.

- One of the most successful and productive research partnerships was that of Drs. A. Ghali and W. H. Dillger who were awarded the 1976 T.Y. Lin Award for the best paper in the prestressed concrete field published in any journal of the three societies: The American Concrete Institute (AC), The American Society of Civil Engineers (ASCE) and The Prestressed Concrete Institute (PCI). The award winning paper co-authored with their graduate student M. K. Tadros appeared in Vol. 22, No. 2, 1977, pp. 50-63.

The most widely used invention started from an initial idea and some tests on flat plate concrete slabs by Dr. Ghaibi with Dr. M. A. Sargous' collaboration in 1968. From there Drs. Ghaibi and Dilger, with a number of co-workers and graduate students, developed a practical, effective and economical shear and reinforcement during the 1970's which has been patented in Europe, Canada, the USA and Australia/New Zealand (see S. J. VER ANNIVERSARY Section of this Chapter).

[illegible]

in another project in which they collaborated with Dr. G.S. Tadros they invented an ingenious construction technique for prestressed concrete bridges which obviates the labor intensive casting of concrete in the prime.

This design is the prime which has been the subject of a number of international projects.

One of the major projects was the design of a \$18,000 contract from the Department of Science and Services (DSS) in 1987. A study was conducted on the marking of prestressed concrete piles subjected to static and impact loads and carried out in collaboration with Sargis & Associates consulting engineers. This project was supported by a \$10,000 contract from the Canadian Federal Association during 1976-80.

- A \$80,000 NRC major capital equipment grant was obtained by Mr. J.F. Gagnon with Dr. H.R. Gagnon and Dr. G. S. Tadros. This equipment for the project was supplied from the SEMI-Canada program. The SEMI-Canada program provides for the purchase of some thermal analysis equipment.
- Dr. J.F. Gagnon was the only staff member in Civil Engineering who

obtained funding from The Alberta Towards Technology and Research Authority (AOS) IRA \$35,000 1977-78 for studies of the microstructure of Alberta oil sands.

- A major step-function in the development of the Alberta Towards Technology and Research Authority (AOS) IRA \$35,000 1977-78 for studies of the microstructure of Alberta oil sands.
- In addition to the regular NRC operating grants, Drs. J.F. Morrall and M.A. Sargious were successful in obtaining over \$250,000 external research funding during the period 1973-79 from various federal, provincial and private sources. These funds were used for research in the areas of energy conservation, fluid flow, and gas movement in Alberta. The two main two-way road highway leading and capital budgeting.



Plate 4.18
of the fibre
section of a
fibre optic
cable through
Related Assistant

a report projects to name but a few. The first monograph on transportation was published during this period by Michel Sargious (see Table 4.1).

A final outstanding achievement is the awards and highlights are mentioned in Table 4.2 at the end of his chapter.



Plate 4.19
A group of people in a meeting room, likely related to the research or administrative work of the department.

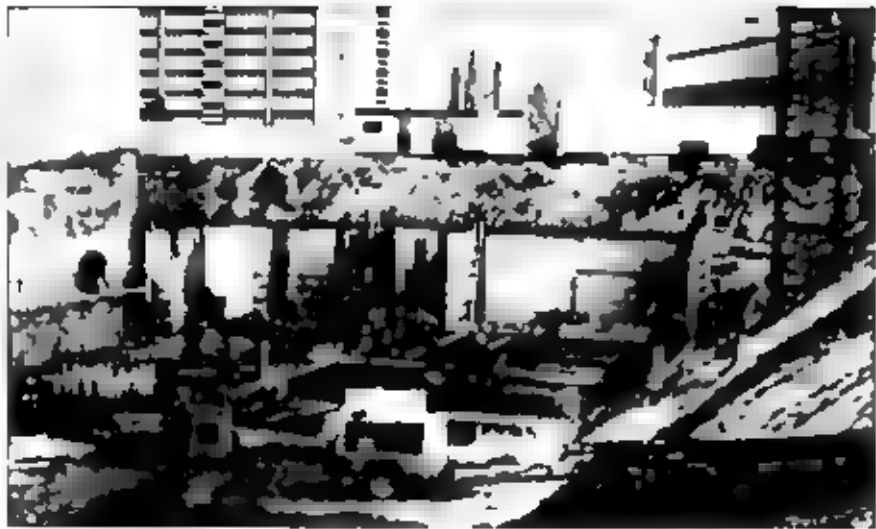




A NEW HOME

A vintage year of major developments was what 1979 was for the Department of Civil Engineering and its Head Dr M A Ward. A 5 year \$1.0 million grant was obtained which helped to establish the first Canadian masonry centre at The U of C on April 1, 1979. Two months later approval and funding of the Surveying Engineering programme was announced which resulted in the establishment of the Division of Surveying Engineering on July 1 and the launching of the third year surveying engineering curriculum in September of that year (See Chapters I and VI). To recognize his leading role in achieving this *Western Canadian first* the Alberta Land Surveyors Association bestowed upon Mike Ward the rare distinction of Honorary Life Membership at its Annual Meeting at the Jasper Park Lodge on April 1981, an honour conferred only on 4 previous occasions.

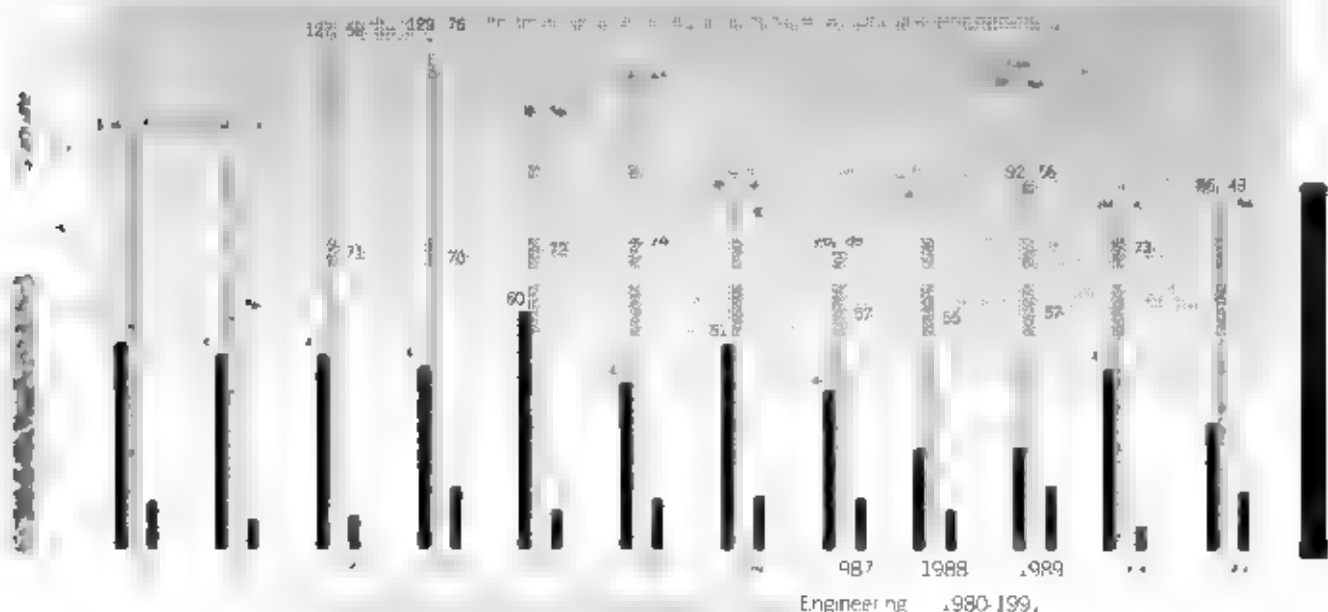
Of the Department's most significant developments of this vintage year's developments, however, was the approval of the New Civil Engineering Building first proposed in the Spring of 1967. Soon after the announcement, the old working drawings were brought out of storage, were dusted off and were examined in the light



the east end of the New Civil Engineering Building
the load-floor being

of current needs. The examination quickly revealed that the changes which occurred in the Department's requirements during the intervening years would necessitate a complete redesign of the building. Art McMillen and Bob Loov spent much of their time during the following year on this task. It was late December 1980 before construction was started and soon thereafter, on the basis of the new design, was progressing.

Plate 4.40, A year later, in the winter of 1982, most of the structural work was complete (see Plate 4.41). In August 1982, more than 15 years after first proposing this extension, the Department was finally able to move into its new home, the F Block, relinquishing part of its old quarters in the E Block to the Division of Surveying Engineering. The new Civil Engineering Building was officially opened on November 8, 1982 (see Plate 2.79).



Clearly Civil Engineering had a very good start into the 1980's. It was experiencing, once again, the excitement associated with growth and development of new facilities. With undergraduate enrolment at respectable levels and graduate student numbers almost doubling during the first 3 years of the new decade (see Fig. 4.5) the future looked bright. The economic fallout of the 1970's which spilled over into the early 80's, provided additional stability and income for projects. External research funding in 1980 reached a new high (see Fig. 4.6) exceeding \$600,000 and including a number of major piece and equipment grants and contracts.

In much of the research activity and in all of the major developments, Mike Ward was involved and/or was a key player. It was, therefore, not surprising that the Civil Engineering academics supported his appointment for an unpaid sabbatical third term Aug. 1, 1981 - June 30, 1984. At first he went on sabbatical leave on Aug. 1, 1980 and, by Nov. became Acting Head for a year. A month earlier, Nigel Shrive had returned to the Department on a full time basis, having served out his 3 year term as Assistant to the Vice President (Services). The academic staff increased further when on September 1, 1980 Dr. Aleksandra M.



Fig. 4.5 Undergraduate and Graduate Enrolment in Civil Engineering 1979-1989

Vinogradova was given a limited term appointment as Assistant Professor after she had been awarded an NSERC University Research Fellowship, LRF (see Plate 4.42).

A highlight for civil engineering students, especially the 4th year class, in the Fall 1980 session was the arrival of 5 German visiting students from the Universität Stuttgart, signalling the start of the Exchange Programme between their institution and the Department of Civil Engineering at our University. The programme is very successful and is continuing (see Plate 4.44). It is

supported by the German Academic Exchange Service (Deutscher Akademischer Austauschdienst, DAAD) and was initiated by Dr. W. H. Diger, a graduate of the University of Stuttgart. This first group of exchange students consisted of Gertard Bahczynski, Manfred Burth, Manfred Clauss, Jwe Kieffer and Stefan Kimmich.

The 5 visitors together with the senior class enjoyed the increased flexibility of the revised 4th year programme which was phased in over 2 academic years, 1979-81, and offered some specialization in Civil Engineering sub-disciplines. The new programme, which was a result of the Faculty-wide curriculum review initiated in 1977, included a new course, ENC 471, *Civil Engineering Systems*, taught by Ian Jordaan between 1979 and 1982 who also offered a graduate course in this field during that period. Stan Rokosh was instructor in the municipal engineering course for the last time in the Winter '81 term.

After his sabbatical leave, Mike Ward continued his efforts to establish a construction management specialization. He succeeded in forming a University-Industry Committee to oversee the planning and development of programmes and courses in this field, including a proposed MEng programme and the 4th year optional projects course, ENC 501, in which Civil Engineering and Scheduling

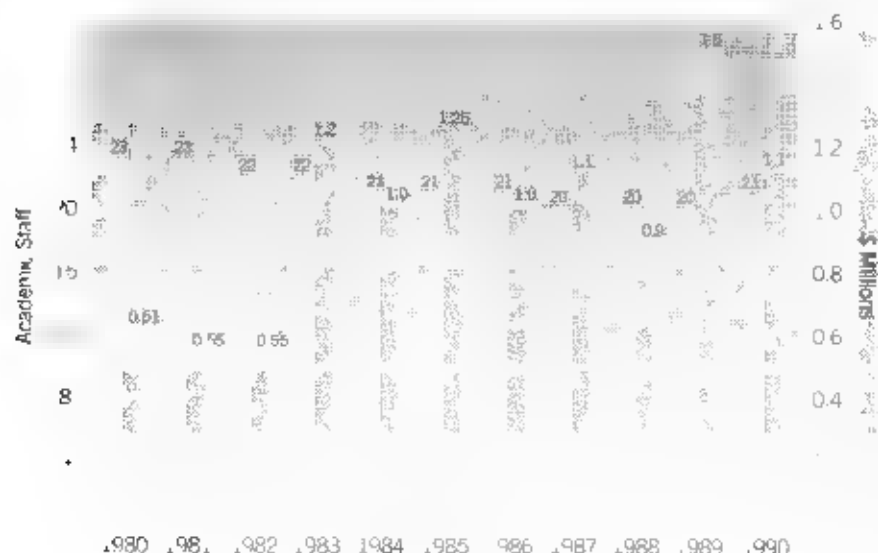


Fig. 4.6 Full-time Academic Staff and Annual External Research Funding in

were treated for the first time during the Winter 1980 term. An undergraduate course *Intro to Cost Engineering* ENCG 506 and two new graduate courses were introduced for the 1981/82 academic year. The latter included a *Construction Management* course offered by Mr. Dick Parker, Vice-President Fluor of Canada Ltd. and a course on *Construction Planning and Scheduling*, taught by Mr. Douglas Warne, Senior Planning Engineer with Parlec (Laval and Mr. Warne continued as Sessional Instructor (Part time) in the Department for over 5 years, until May 1987, by which time the Project Management Specialization PMS was a firmly established programme with Rod de Paiva its Director. Details of the development of the PMS are briefly reviewed in Appendix F.

The Canadian Accreditation Board CAB team visited on Oct. 29/30, 1981. In their final report they were critical of the lack of staff and facilities in the areas of water resources and geotechnical engineering. Appointments in these specializations became highest priority for the Department. This CAB report in the Spring of 1982 was but the beginning of a series of events which clouded the final 2 years of Mike Ward's term of office and dampened the joy and sat-

isfaction derived from seeing the new Civil Engineering Building become a reality. During that spring, an Jordanian handed in his resignation effective Aug. 31, 1982. He was appointed Adjunct Professor and continued to be associated with the Department until he moved to St. John's in July 1988. Early in 1983, Marshall Gysi indicated his intention to leave at the end of Aug. 83 which made an appointment in the water resources area even more urgent. Mike Ward's last full time permanent appointment was the hiring of Mr. David H. Manz as Assist. Prof. effective September 1, 1983, who completed his dissertation and obtained his PhD in water resources engineering at the U of A in 1984 (see Plate 4.42).

Also during the Spring of 1983 the Department was informed that Aleksandra Vinogradov's NSERC CRF was to be terminated on Dec. 31, 1983, effectively ending her limited term appointment as of that date. She was hired as Sessional Instructor to retain her as a member of the Department's teaching force until July 1984. Adjunct appointments maintained her association with Civil Engineering till June 30, 1987.

As if to make up for the loss of the Vinogradov CRF, Dr. Robert L. Day was awarded such a Fellowship. After notification was received Bob Day's appointment as Sessional Instructor, which he held since Jan. 1, 1983, was changed to an Assistant Professorship for a 5 year term effective May 1, 1983. Five years later, when his CRF was renewed for a second 5 year period, Dr. Day was given an initial term appointment (see Plate 4.42).

A most dramatic and unhappy event for Civil Engineering was the tragic death of Bruce and Carol Irons during the first week of December, in 1983. The suddenness and tragedy of their act struck a blow moved everyone in the Department and the Faculty and reminded us of the fragility and finiteness of human existence. The passing of Bruce Irons repre-



R. L. Day
1983



A. M. Vinogradov
1983



D. H. Manz

sented a significant loss in the Department's strength in computational mechanics, particularly in the fundamentals of finite elements. Unfortunately, no replacement was hired. Instead, it was decided to respond to the CAB criticism and use the position for a geotechnical appointment with the search getting under way in the Spring of 1984. To help with the teaching load during the winter term, Dr. Thomas G. Brown was hired as Sessional Instructor on Jan. 1, 1984. Tom (PhD '74) had been Asst. Prof. (Part time, during the winter term of 1977 and after a 6 year stay in Saudi Arabia was back in the Department as Research Associate and was available on short notice. He has held sessional appointments since 1984 and as of Oct. 1986 also holds an Adjunct Professorship in Civil Engineering (see Plate 4.46).

The Department's high spirits resulting from the move into the new facilities was buoyed by the record undergraduate and graduate enrolments in the Fall of 1982 and 1983 (see Fig. 4.5). There were, however, signs of hard times ahead. Job opportunities for Civil Engineering graduates suddenly became very limited. Enrolments across Canada and the U.S. decreased in comparison with pre-1982 figures. The drastic drop in the number of the 2nd year students electing Civil Engineering as their first choice was correctly identified at the June 13th 1983 departmental meeting as a serious warning sign. Fortunately, undergraduate student numbers continued at reasonable levels for a further 2 years before the severe downturn in the economy affected and reduced the Civil Engineering enrolment in the Fall of 1986. Interestingly, graduate student registration that fall reached a new maximum which was not to be attained again until 1991 (see Fig. 4.5). The level of external research funding, which

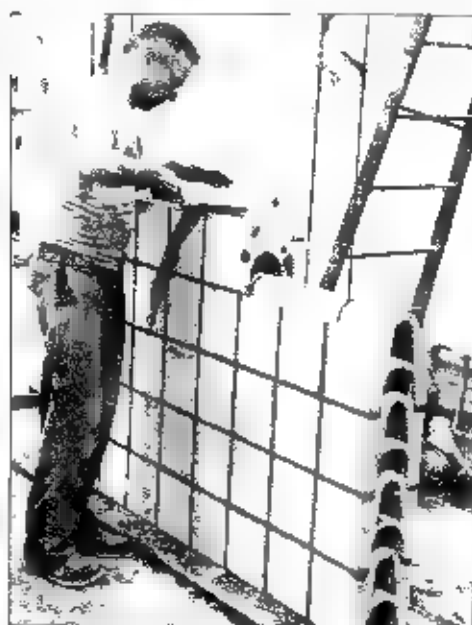


Plate 4.44: Mr. Robert L. Day, Asst. Prof. in Civil Engineering, standing on a construction site. The photo was taken in 1983, during the construction of the new Civil Engineering Building. The building was completed in 1984.

1. 4. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839

for the period Jan 1, 1985 - June 30, 1986 see Plate 446.

on thread and glue. Prize winners in the *individual* competition were Lorne Grundmann and Peter Wessener, freshman and sophomore, respectively. The *group competition* was won by T. Luu, R. Darwent and E. Kwan from 1st year and D. Freeman and R. Harper from 2nd year. The second and final Pasta Bridge Contest was held during the week of Feb. 24, 1986 and was organized by Art McMullen. Its first prize winner was again Mr. E. Kwan with his 161 gram cannelloni bridge model which carried nearly 130 times its weight before collapsing.

The staff increase due to the arrival of Bryan Karney on New Year's Day 1985 was augmented in some sense by Rod de Farias who on July 1 after nearly 14 years of Vice Presidency. Although Rod went on sabbatical leave he spent most of his time in preparing himself for the job of Director of Project Management after Warren Allen suddenly left at the end of 1985. Bruce Gambie decided to return to his home in New Zealand and resigned effective Dec. 31, 1985. When Michele Sargious came back on July 1 after completing his year in the Dean's office it appeared that, for a change at least, the staff who are not on leave would be available on a full time basis. That illusion was soon dispelled when Nigel Shrive was appointed Assoc. Dean, Student Affairs, on Sept. 1, 1985.

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| M ¹¹¹ | h | h | h ¹¹² | M ¹¹⁴ | h ¹¹² | h ¹¹⁰ | f | h ¹¹² | h ¹¹⁰ | h ¹¹⁰ | |

Plate 4.47 who was to be responsible also for the next three of these annual events. The Student Exchange Programme between Calgary and Stuttgart also posed a first. After five years of operating the programme became a two-way exchange when Mr. Eric N. Gerlach BSc '85, one of our graduates, became the first Canadian to go to the University of Stuttgart to obtain a Dipl.-Ing. degree after further 3 years of study.

From the day of his appointment as Head, Bob Loov was trying to fill the gentechnical position for which Dr. Aleksandra M. Vojnovic was an applicant and a short listed candidate. During the Fall of 1984 the university placed a freeze on all hirings which effectively stopped the appointment procedure. Substantial time and energy was spent on this matter after July 1985 when Aleksandra Vojnovic initiated litigation and an investigation by the Alberta Human Rights Commission on the grounds of alleged discrimination actions which led to Bob Loov stepping down from the chair and Mche Sargous being appointed Acting Head on July 1, 1986. On the same date Rod de Paiva became Director of the Project Management Specialization.

The most significant change in staff during Dr. Sargous term as Acting Head was the departure of Bryan W. Karney on June 30, 1987 when his limited appointment was not renewed due to pressures on reallocation of the Department's resources resulting from lower enrollments. The Department and



R.F. Loov



W.F. Auer



R.W. Karney



T.J. Brann

Plate 4.46: The fourth Head of Civil Engineering with new appointees.

Mche Sargous urged strongly against this loss with no avail. On Jan. 1, 1988 Dr. S.C. Whittington was appointed the first Associate Dean, Research in the Faculty of Engineering. Howard Johnson took early retirement after nearly 30 years of service and Terry Nal became Technical Supervisor on May 1, 1988.

A highlight for the academic staff during the Spring of 1988 was the Annual Meeting of the Canadian Society for Civil Engineering (CSCE) organized and held in Calgary May 25-27 under the chairmanship of Bob Loov.

After the Human Rights Commission released its final report in which it stated that no discrimination had occurred against Aleksandra Vojnovic, Bob Loov was reinstated as Head on Sept. 15, 1988. He served out his 5 year term and was succeeded on July 1, 1989 by Dr. N.C. Shrive who relinquished the position of Assoc. Dean, Student Affairs to Dr. R.L. Day. The only other change in administration during the

period under review occurred when Mrs. Mche Marshall, after more than 14 years as Departmental Secretary, retired on Jan. 31, 1989 to be succeeded by Ms. Carolyn I. MacArthur. Nige Shrive's first two academic appointments prior to 1992 were discussed in the first section of this chapter (see Plate 4.48).

In reviewing the research and professional contributions from the Department, two aspects are strikingly common for a significant number of the staff: 1) the degree to which the research and professional activities are international in scope and 2) the extent to which the expertise residing in the Department is tapped and used by national and international scientific and professional societies and associations in the creation, review or modification of codes, practice standards and specifications for the various Civil Engineering subdisciplines. Let us briefly comment on both of these aspects.

The Civil Engineering academics, as much and perhaps more than those in any of the other 4 departments, are involved in research and development work and professional activities in countries around the globe including projects in Argentina, Australia, Bolivia, China, Egypt, Guatemala and Mexico, Nepal, New Zealand, Peru, Philippines, Sri Lanka, Tasmania, Thailand, Zululand and the U.S. and various countries in Europe. The involvement of the staff in projects for developing nations is a direct consequence of the need for expertise in the various Civil Engineering disciplines to accomplish the mammoth task of tapping available energy, water, mineral, agricultural and forestry resources and upgrading existing infrastructure including new energy and water distribution, transportation, health and education, communication and environment protection systems.



Plate 4.47: The first award given to a graduate of the Department of Civil Engineering. The award was given to Mr. Eric N. Gerlach BSc '85, one of our graduates, who became the first Canadian to go to the University of Stuttgart to obtain a Dipl.-Ing. degree after further 3 years of study.

and associated infrastructures in those countries. Involvement in such undertakings is facilitated and the necessary financing usually provided by federal and provincial or state agencies in Canada and the U.S. such as the Canadian Int. Development Agency (CIDA), the Int. Development Research Centre (IDRC) in Ottawa, the Secretary of State, as well as various state and provincial agencies and special programs and organs of the United Nations including the World Bank.

Using results of their research, contributions by the Civil Engineering staff to the work of key code and standards committees of national and international technical and professional societies is equally impressive. Thus, for example, Jack Gillott has served on CSA (Canadian Standards Association) Committees concerned with cement and concrete aggregates and was recipient of CSA's Award for outstanding contributions to research on alkali aggregate reactivity in August 1986. Colin Johnston continues to be a member or chairman of several ASTM (American Society for Testing and Materials), ACI (American Concrete Institute), and CSA committees responsible for codes dealing with the

testing and properties of fibre reinforced concrete, ferro cement, super plasticizers and admixtures. In recognition for his many years of outstanding service as chairman of the Subcommittee on Fibre Reinforced Concrete, he was awarded ASTM's prestigious *Certificate of Appreciation* in June 1991. Amin Ghaï contributed to the work of ACI committees dealing with specifications for circular prestressed concrete structures and concrete bridge design. He was also a member of a joint ACI/ASCE (American Society of Civil Engineers) committee on the design of concrete slabs. Walter Diger was active on ACI/ASCE joint committees dealing with shear and diagonal tensions on joint design and esthetics in bridge design. He was chairing a CSA Subcommittee which produced Chapter 10 *Prestressed Concrete*, by P. Breeze, W. H. Diger and R. E. Loov in the *Concrete Design Handbook* (CDH) published by the Canadian Port and Cement Assoc. (CPCA) in 1985. Bob Loov was a co-respon-

sible for Chapter 7 *Short Columns*, in the CDH. In addition to being member or chairman of CSA Committees on test methods for concrete, precast concrete, welding of reinforcing steel bars and cold formed steel members, respectively. He also served on an ASTM committee responsible for surface finish specifications. For his outstanding service on committees for concrete design and construction and for his research and technical contribution to the development of concrete construction standards, Bob Loov was selected as winner of a *CSA Award of Merit* presented at the Association's Annual Meeting, June 16, 1992 in St. John's, Newfoundland, where Mrs. Loov and he were guests of CSA. A number of CSA Committees dealing with specifications for masonry materials and structures were chaired by Nige Shrive. Other staff members involved in committee activities include Bob Day, Bruce Gamble, Peter



N. G. Shrive



F. T. Hameed



D. H. Hameed

Figure 4.48: The Head of Civil Engineering with new members.

Glockner, Art Haeizer, Ramesh Joshi, Art McMullen, Michel Sargious and Mike Ward.

In addition to the highlights described or illustrated above or in the SILVER ANNIVERSARY Sections of Chapters I and V, noteworthy events for Civil Engineering during the period under review include the following:

- After expiry of the 5 year NDG in July 1979 (see previous Section) 4 of the Civil Engineering members of UNISIL, including Drs. Gillott, Jordaan, Loov and Shrive referred to hereafter as the Civil Engineering Sulphur Group (CESG) supported the sulphur related research through a 2 year \$75,000 grant from SJDIC (1979-81), with an additional \$10,000 for 1982-83 and through participation in a 3 year \$60,000 NSERC Co-op Grant spearheaded by Dr. J. B. Hyne. A highlight for the CESG was the *Sulphur '81 Conference* held May 25-28, 1981 at Calgary and sponsored by the Province, SJDIC and the British Sulphur Corporation. At this, the first in a series of international conferences the sulphur concrete designed at The U of C was acknowledged to be a firmly established useful new construction material indispensable in certain applications (see *Proc. Sulphur '81* pp. 395-397).
- Drs. W. H. Diger and A. Ghaï in collaboration with Stanley & Associates consulting engineers were awarded a further 3 year \$110,000 contract in 1981 by the Canadian Electrical Association for work on a new technology for precast concrete poles.
- An application by 9 members of the Structures and Materials Groups spearheaded by Dr. W. H. Diger as principal applicant, resulted in a \$365,000 NSERC major installation grant in the



Figure 4.49: Nige Shrive, Art Haeizer and Jan Tiller are discussing details of the construction and testing of a 1.8 m x 3.0 m x 0.6 m masonry diaphragm wall. (Winter 1981)

Spring of 1983 which provided funds for state-of-the-art equipment for the new Structural Laboratory.

- In February 1985, Dr S.C. Wrasinghe was awarded a 3 year \$220,900 grant by the Int. Development Research Centre (IDRC) for a cooperative study with the University of Moratuwa, Sri Lanka on intercity travel demand modelling and forecasting for that country. The grant was the first of its kind in Alberta.
- Dr J.E. Gault obtained funding from AOSTRA in the amount of \$203,350 over a period of 4 years (1983-87) for a study on the behaviour of oil well cements at elevated temperatures.
- Studies on the effects of fly ash on concrete properties were initiated by Prof. R.H. Mills and his MSc student Mr. J.P. Varma (1967-69) followed by work of graduate students supervised by Dr. M.A. Ward. Funding specifically earmarked for research on the use of this by/waste product in the production of low strength concrete and structural fill was first obtained by Drs. R.C. Joshi and M.A. Ward in 1978-79 from The Western Fly

Ash Co. Calgary Power and the Alberta Environmental Research Trust (AERT) totalling \$48,500. They also obtained a \$24,500 one year contract in 1982 from the Canada Centre for Mineral and Energy Technology (CANMET) Dept. of Energy, Mines and Resources, EMR. Fly ash related activity shifted into high gear when a 3 year \$445,320 NSERC Strategic Grant was awarded to Messrs. M.A. Ward, R.L. Day, R.C. Joshi and B.W. Langan in Nov. 1983 for a study on increasing the use of fly ash in construction, resulting in the formation of the Calgary Fly Ash Research Group (CFAR) early in 1984. Additional support was obtained by M.A. Ward and B.W. Langan in the form of a 2 year \$51,000 PRA grant (Dec '84) as well as a 2 year \$42,000 NSERC Co-op R&D grant (Apr '87) for a study on the use of fly ash in precast concrete. Prof. Joshi obtained a 4 year \$20,000 contract with TransAlta Fly Ash Co. (Sept '82) for an investigation of fly ash utilization in Geocrete.

With so much fly ash related work in progress, it was not surprising that a member of the CFAR, Dr. R.L. Day was awarded a 4 year \$237,950 IDRC grant in Aug. 1986 for a cooperative study with Guatemala on the use of natural pozzolans (volcanic ash) in masonry materials and construction. Messrs. Joshi and Huzar were involved as consultants. An analogous study in Bolivia was undertaken in Sept. 1988. (See SILVER ANNIVERSARY Section in this Chapter).

- Dr. C.Y. Cha was invited to present 8 seminars on nonlinear theory and analysis of laminated anisotropic plates at 3 research centres and universities in China, Aug. - Sept. 1983.
- With an MSc student, Mr.



Plate 4.50 — Dr. J.E. Gault (R) and his co-workers, L to R: Mr. T. Quinn, Dr. H. Wang, Mrs. E. Grabowski, discussing the use of the Scanning Electron Microscope in the structural analysis of concrete. 1992

B. Jameson, and a one year \$11,460 grant from the Alberta Recreation, Parks and Wildlife Foundation. Dr. C.D. Johnston started his research on in situ tensile strength of snow in relation to slab avalanche in Sept. 1987 (see Plate 4.52).

- With funding from the City of Calgary in the amount of \$53,800 (1980-83), Dr. John F. Morral studied downtown pedestrian movements and parking requirements at the Light Rail Transit (LRT) stations. He also obtained grants and contracts (1983-84) from Parks Canada (\$45,723) and Alberta Transportation (\$31,728) for studying optimum locations and design of passing lanes for the TransCanada Highway in the Banff National Park, the Yellowhead Highway, the Redfields Parkway and two lane highways in Alberta.
- Soon after the opening of the South Leg of the Calgary LRT System, problems developed with the track fixation system. Drs. Gambie and Shrive carried out extensive studies on the fracture/failure of the pads and track support system and on the design of an improved track fixation system for the NE and NW legs. They also studied and made recommendations on reducing or eliminating track corrugations in the LRT system. Total funding for these studies exceeded \$0.25 million between 1983 and 1987.
- During and after the expiry of the 5 year fixed grant from Industry, Trade and Commerce, masonry research was supported by special

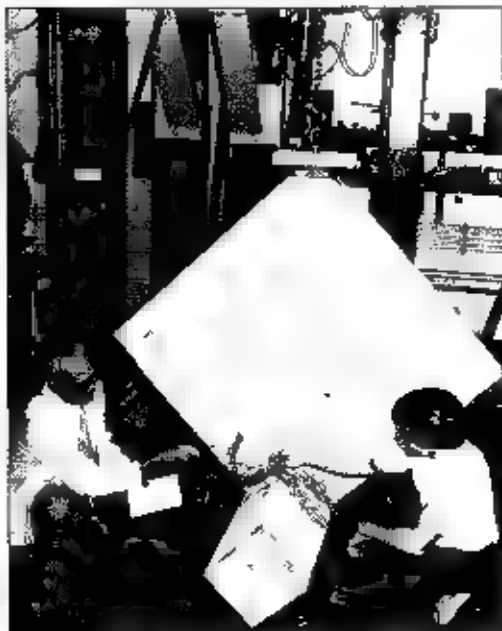


Plate 4.51 — Dr. A. Yin Chai (L) and his MSc student, Mr. Nien Hamami are discussing the mode of failure of a full-scale flat plate concrete slab specimen after testing and removal from the test rig. The test programme is aimed at an investigation of the shear resistance of slabs in the vicinity of a corner column support. Spring, 1992

grants such as the \$24,500 PRAI grant to A. Huzar (1982-83) for a study of masonry chimney problems and a \$26,000 NSERC Co-op grant 1984-85 to N.G. Shrivie for work on the design of an efficient load-bearing concrete block.

- During 1985-87 Dr. D.H. Manz obtained grants and contracts from Alberta Environment (\$57,430), and Alberta Agriculture (\$23,500) for work on the application of his Irrigation Conveyance Systems Simulation (CSS) Computer Model to the study of the hydraulics and operation of a 50 km stretch of the St. Mary River Irrigation District main canal and an investigation into the relationship between canal seepage, groundwater table and phreatophytes growing adjacent to canals. His international activities, including projects in China, Egypt, India, Mexico, the Philippines, Tanzania and Zuluana, are funded by such organizations as CIDA and the World Bank (see Plate 4.53).
- The first FIP (Federation internationale de la Precontrainte) sponsored symposium in Calgary was held Aug. 25-31, 1984 and was co-sponsored by the Canadian Prestressed Concrete Institute (CPCI). Drs. A. Ghali and R.E. Loov were involved in organizing this international meeting.
- The Second Symposium on Systems



Plate 4.52 Dr. Colin D. Winston taking shear strength, density and temperature profile measurements of the snow cover in a snow pit at the Mt. S. A site study plot for avalanche research, Blue River, B.C. Elevation approx. 1900 m. View towards East, with peaks of the Monashee Mountain Range in the background. 988

Theory for the Civil Engineer was organized by Dr. S.C. Wirasinghe and held at The U of C on May 17-18, 1984.

- Dr. J.E. Griott attended the 27th Int. Geological Congress in Moscow as invited speaker and as guest of the USSR Academy of Sciences Aug. 4-14, 1984.
- By invitation Prof. A. Ghali gave a series of lectures on Computer Methods of Structural Analysis and Finite Elements at the Faculty of Civil Engineering, University of Nuevo Leon, Monterrey, Mexico.

Jan. 15-24, 1984.

- Dr. R.E. Loov was an invited delegate of the Cold Weather Regions Research Mission to Alberta's sister provinces in Hokkaido, Japan and Heilongjiang (Manchuria), China, March 1-18, 1985. The tour was aimed at establishing areas of cooperation in cold weather science and technology in agriculture and engineering. It led to Bob Loov's second visit to China, June 15-25, 1987, when he presented 8 lectures to staff and students of the N.E. Forestry University in Harbin, Heilongjiang.
- A successful *Int. Symp. on Prediction and Performance in Geotechnical Engineering* was organized under the chairmanship of Dr. R.C. Joshi and held at The J of C, June 17-19, 1987.
- During his visits to the Universidad Nacional de Ancash, Santiago Antunez de Mayo, U.N.A.SAM, Peru, in August 1987 and again Aug. 1988, Dr. John F. Morra presented lectures on mountain highway engineering and discussed a CIDA supported research project proposal administered by the Int. Development Division at The J of C.



Plate 4.53 Dr. D.H. Manz with 3 of his M.Sc. students during a field trip to Park Lake, a reservoir within the Lethbridge Northern Irrigation District, to assess the feasibility of using his irrigation conveyance system simulation (CSS) for modelling the canal. The group is relaxing in a boat on the reservoir and the east shore, at a fire on the lake. View towards West, to R. Menzies, D.H. Manz, A.E. Marway, Z. Lin, M. S. Ghalje. Aug. 99.

Additional details of highlights and outstanding achievements by staff and students as well as administrative and personnel history and statistics are indicated in Tables 4.1-4.4 at the end of Chapter IV.

THE UNIVERSITY

OF CALGARY

CIVIL ENGINEERING GRADUATES

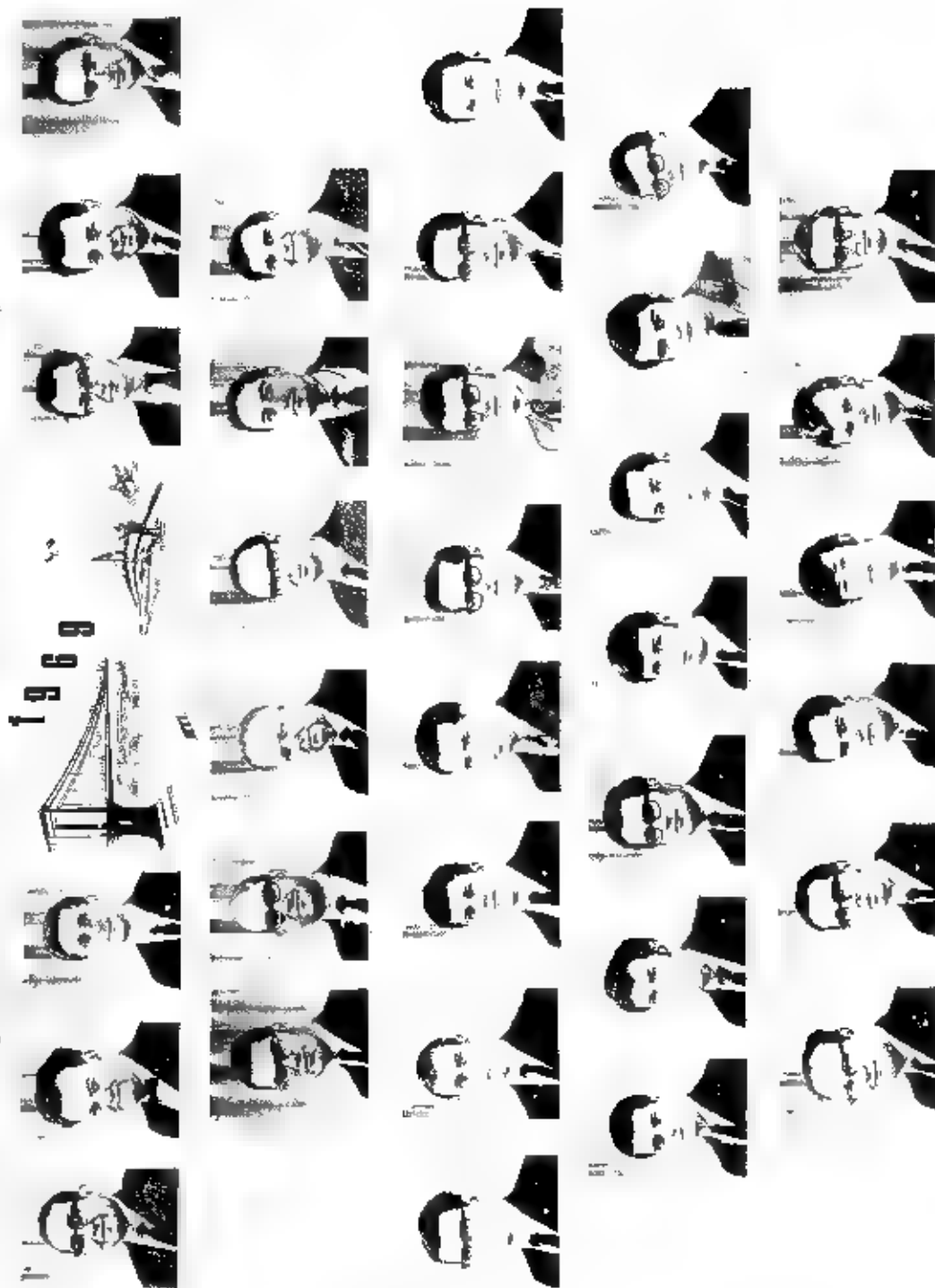


Plate 4.54 — The first Civil Engineering graduating class - May 1969.

Table 4.1 STAFF AND ADMINISTRATION — 1990-91
DEPARTMENT OF CIVIL ENGINEERING

| | | |
|--|--|--|
| HEAD: Dr. Shrive, N.G.
Secretary: Ms. McArthur Carolyn | ACADEMIC STAFF
Dr. Chia, C.Y.
Dr. Day, R.L.
Dr. de Paiva, H.A.R.
Dr. Diger, W.H.
Dr. Ghali, A.
Dr. Gillett, J.E.
Dr. Glockner, P.G.
Prof. Hartman, F.T.
Mr. Huizer, A.
Dr. Johnston, G.D.
Dr. Joshi, R. | Dr. Kuhlmeier, R.L.
Prof. Langan, B.W.
Dr. Loov, R.E.
Dr. Manz, D.
Dr. McMullen, A.E.
Dr. Morrill, F.
Dr. Muzik
Dr. Sargous, M.A.
Dr. Shrive, N.G.
Dr. Ward, M.A.
Dr. Wirasinghe, S.C. |
| ASSOCIATE HEAD: Dr. McMullen, A.E.
(Undergraduate Studies). | | |
| ASSOCIATE HEAD: Prof. Langan, B.W.
(Graduate Studies). | | |
| DIRECTOR: Dr. de Paiva, H.A.R.
(Project Management)
Secretary: Ms. Takaoka, Kayla | | |
| SECRETARIAL STAFF
Ms. Anand, Susan
Ms. Kadach, René
Mrs. Sherman, Patricia E. | VISITING PROFESSORS, RESEARCH ASSOCIATES,
ASSISTANTS, PDF's AND SESSIONAL INSTRUCTORS
Dr. Bandara, J.
Dr. Ghuta, C.
Mrs. Czamecki, B.
Dr. Elbadry, M.
Dr. Fu, Y.
Mr. Gifford, P.
Mrs. Grabowski, E.
Dr. Hettiaratchi, P.J.
Mr. Jamieson, J.B.
Mr. Janakuraman, C.
Dr. Kakuta, S. | Dr. Kaniraj, S.
Mr. Krolcek, P.
Dr. Okamoto, T.
Dr. Sato, Y.
Dr. Strupczewski, W.
Mr. Susheel, G.
Dr. Sze, K.Y.
Dr. Wang, H.
Dr. Wijeweera, H.
Dr. Zou, J.X. |
| TECHNICAL STAFF
Supervisor: Mr. Nail, Terence F.
Mr. Anson, Donald F.
Mr. Clarke, Cory
Mr. Damson, Eric L.
Mr. Lhenen, Frederick N.
Mr. McCullough, Donald E. | Mr. Pollard, R. Harry
Mr. Quinn, Terence
Mr. Tilleman, Daniel D.
Mr. Yates, D.
Mr. Rao, K.P. | |

Table 4.2 TIME LINE OF ADMINISTRATION - 1966-1991
DEPARTMENT OF CIVIL ENGINEERING

| Year | Head | Departmental Secretary | Associate Head(s)
Programme Director(s) | Technical Supervisor/
Laboratory Manager |
|------|---|--|---|--|
| 1966 | A.M. Neville/B.B. Hope
(07.01.12-31) | E. Boyd
(07.01) | | M.A. Ward*
(07.01) |
| 1967 | R.H. Mills
(01.01) | E. Boyd
S. Jamniczky
(67.03.01-68.01.31) | — | M.A. Ward*
A. Huizer†
(04.01) |
| 1968 | R.H. Mills | P. Douglas
(68.02.16-69.02.21) | | M.A. Ward*
M.A. Ward*
(till 09.30)
H. Johnson
(10.01) |
| 1969 | R.H. Mills | J. McClellan
(02.24-) | | A. Huizer†
H. Johnson
A. Huizer†
(till 01.31)
H. Johnson |
| | H.A.R. de Paiva
(08.01-) | McClellan | | |
| 1971 | P.G. Glockner
Acting
(11.18-) | J. McClellan | | H. Johnson |
| 1972 | M.A. Ward
(08.01-) | J. McClellan | | H. Johnson |
| 1974 | M.A. Ward | M. Marshall
(10.08-) | — | H. Johnson |
| 1980 | R.E. Loov
Acting
(08.01-) | M. Marshall | — | H. Johnson |
| 1981 | M.A. Ward
(08.01-) | M. Marshall | — | H. Johnson |
| 1984 | R.E. Loov
(07.01-) | M. Marshall | W. Allen‡
(84.07.01-85.12.31) | H. Johnson |
| 1986 | M.A. Sargious
Acting
(07.01-) | M. Marshall | H.A.R. de Paiva‡
(07.01-) | H. Johnson |
| 1988 | R.E. Loov
(09.15-) | M. Marshall | H.A.R. de Paiva‡ | T.F. Nail
(05.01-) |
| 1989 | N.G. Shrive
(07.01-) | C.J. MacArthur
(02.01) | H.A.R. de Paiva‡ | T.F. Nail |
| 1991 | N.G. Shrive | C.J. MacArthur | B.W. Langan
(Graduate Studies)
(07.01)
A.E. McMullen
(Undergraduate Studies)
(07.01-)
F.T. Hartmann‡
(07.01) | T.F. Nail |

*Supervisor of Laboratories; †Laboratory Manager; ‡Director of Project Management Specialization

II Graduate Scholarship, Medal and Prize Winners (cont'd)

(c) I.W. Killam Memorial Scholarship

| | | | |
|--------------------------------|----------------------------------|-----------------------------------|------------------------------|
| 1971 Brown, T.G. (3 years) | 1980 Ghoneim, N.S.A.M. (3 years) | 1983 Maes, M.A. (3 years) | 1986 Wijeweera, H. (3 years) |
| 1975 Ghoneim, G.A.M. (3 years) | 1981 Nessim, M.A. (3 years) | 1984 El-Badry, M.M.A.H. (3 years) | 1992 Achan, Gopal |
| 1976 Elsayaf, A.F.Y. (2 years) | 1981 Sivakumaran, K.S. (2 years) | 1984 O'Brien, E.J. (2 years) | |

(d) The Canadian Commonwealth Scholarship

| | |
|---------------------|--------------------------|
| 1972 Rao, V.J. | 1990 Ariyawarden, N. |
| 1979 Amerly, P. | 1991 Ariyawarden, N. |
| 1979 Mitchell, M.A. | 1992 Ariyawarden, T.M.D. |

(e) Province of Alberta Graduate Scholarship/Fellowship

| | | |
|----------------------------|----------------------|----------------------|
| 1967 Dawson, R.V. | 1976 Khalil, M.S.A. | 1986 McInnis, D.A. |
| 1972 Salinas-Pacheco, J.J. | 1980 Czarnecka, E.T. | 1988 Griffiths, F.J. |
| 1976 Aki, F.A. | 1984 Grabowski, E. | 1991 Talarico, R. |
| Kellin, K.C. | 1986 Griffiths, F.J. | |

(f) Others

| | | | |
|--------------------|---|--------------------|--|
| 1971 Smith, G.J. | English Speaking Union Award | 1987 Simbeya, K.W. | Alberta Heritage Foundation Medical Research St. |
| 1977 Perich, F.M. | Can. Transportation Research Forum Prize | Smyth, M. | Centre for Frontier Engineering Research Sch. |
| 1979 Maes, M.A. | S.S.H.R.C. of Canada Cultural Exchange Scholarship | Sirosh, S. | Harry & Laura Jacques Bursary |
| 1982 Mokhtar, A.A. | Harry & Laura Jacques Bursary | Willis, K. | Ralph Steinhauer Award of Distinction |
| 1983 Grabowski, E. | Ian N. McKinnon Memorial Fellowship | Willis, K. | Ralph Steinhauer Award of Distinction |
| 1984 Grabowski, E. | Archibald Wayne Dingman Memorial Graduate Scholarship | Wu, A.K.H. | Bruce M. Irons Memorial Scholarship |
| | | van der Voet, A.F. | Bruce M. Irons Memorial Scholarship |
| 1985 Lam, T.C. | Alberta Heritage Foundation Medical Research Studentship | McPherson, R.W. | Arthritis Society Scholarship |
| | | McPherson, R.W. | Alberta Heritage Foundation for Medical Research St. |
| 1987 Jamieson, B. | Alberta Recreation, Parks & Wildlife Foundation Scholarship | Tuladhar, R. | Bruce M. Irons Memorial Scholarship |
| | | McPherson, R.W. | Alberta Heritage Foundation for Medical Research St. |
| Lam, T.C. | Alberta Heritage Foundation Medical Research Studentship | Megally, S.H. | Bruce M. Irons Memorial Scholarship |
| | | Talarico, R.J. | J. Varden Memorial Scholarship |

III Staff Awards and Achievements

| | | | |
|-----------------------|--|----------------------------|--|
| 1963 Neville, A.M. | Properties of Concrete Pitman and Sons, London, 1963. | 1980 Chia, C.Y. | 'Nonlinear Analysis of Plates' McGraw-Hill, 1980 |
| 1965 Neville, A.M. | 'Basic Statistical Methods for Engineers and Scientists' Intertext 1965 (with J.B. Kennedy) | Dilger, W.H. & Ghali, A. | Canadian and West German Patents on 'Shear head reinforcement for R/C flat plates |
| 1966 Neville, A.M. | Awarded DSc, U. of London | Shrive, N.G. | ESS Faculty of Engineering Superior Teacher Award |
| Neville, A.M. | Elected Fellow of ASCE | Ward, M.A. | Elected Honorary Life Member Alberta Land Surveyors Assoc. |
| 1967 Cheung, Y.K. | NRC Senior Research Fellowship | | |
| | 'The Finite Element Method in Structural and Continuum Mechanics' McGraw-Hill Co. Ltd., 1967 (with O.C. Zienkiewicz) | 1983 Gillott, J.E. | U.S. Patent on 'Freeze-Thaw Durable Sulphur Compositions |
| 1968 de Paiva, H.A.R. | NRC Senior Research Fellowship | Jordaen, J. | |
| Neville, A.M. | ACI's Staunton Walker Award | Loov, R.E. | |
| 1970 Dilger, D.H. | Creep in Plain Reinforced and Prestressed Concrete North Holland, 1970 (with A.M. Neville) | Shrive, N.G. | |
| | Participant in Canada-French Cultural Exchange Programme | Irons, B.M. & Shrive, N.G. | 'Finite Element Primer' Ellis Horwood Publ. 1983 |
| 1971 de Paiva, H.A.R. | EIC's Gzowski Gold Medal | 1984 Johnston, C.D. | President, Alberta Chapter of ACI |
| Glockner, P.G. | EIC's Gzowski Gold Medal | Shrive, N.G. | Renée Redfern Hunt Memorial Prize |
| Ward, M.A. | Elected Honorary Life Membership, Alb. Ready Mixed Concrete Assoc. | Ward, M.A. | Elected Fellow of CSCE and EIC |
| 1972 Ghali, A. | 'Structural Analysis' A Unified Classical and Matrix Approach' Int. Textbook Co. 1972 (with A.M. Neville) | Ghali, A. | Elected Fellow of ACI & ASCE |
| | DAAD Award | Morrall, J.F. | President's Medal of Roads and Transp. Assoc. of Canada (with Les Blight) |
| 1973 Cheung, Y.K. | Awarded DSc, U. of Wales, Swansea | 1986 Chia, C.Y. | Fifteen invited seminar lectures at 10 different universities in China |
| Dilger, W.H. | Martin P. Korn Award (with M.P. Werner) | Ghali, A. | Elected Fellow of CSCE |
| 1975 Kuhlmeier, R.L. | NRC Senior Industrial Fellowship | Ghali, A. | 'Concrete Structures: Stresses and Deformations' Chapman & Hall Ltd. (with R. Favre) |
| Morrall, J.F. | President's Medal of Roads and Transp. Assoc. of Canada (with A. Werner) | Gillott, J.E. | CSA's Special Outstanding Research Award |
| | | Huizai, A. & Day, R.L. | 'Engineering Drawing with Computer Applications' The J. of C.P. Serv. |
| Sargious, M.A. | Pavements and Surfacing for Highways and Airports' Applied Science Publ. Ltd. 1975 | 1987 Dilger, W.H. | J.S. Post Tensioning Institute's Award of Excellence |
| | ASCE's T.Y. Lin Award (with Tadros, M.K.) | Gillott, J.E. | 'Clay in Engineering Geology' 2nd ed. Elsevier N.Y. |
| Dilger, W.H. | ASCE's T.Y. Lin Award (with Tadros, M.K.) | Irons, B.M. & Shrive, N.G. | 'Numerical Methods in Engineering and Applied Science' Numbers Are Fun' Ellis Horwood Publ. |
| Ghali, A. | ACI's Leonard G. Wason Medal (with R.A. Coleman) | Johnston, C.D. | Elected Fellow of ACI |
| 1976 Johnston, C.D. | Alberta Achievement Award for Excellence in Concrete Engineering | Loov, R.E. | Eight invited lectures at N.E. Forestry Univ. Harbin, China |
| Johnston, C.D. | Awarded DSc, U. of London | 1987 Shrive, N.G. | Am. Orthopaedic Soc.'s Clinical Science Award (with others) |
| 1977 Gillott, J.E. | Elected Fellow, Royal Society of Arts | 1988 Dilger, W.H. | Portland Cement Association's 1988 Concrete Bridge Award |
| Gillott, J.E. | Elected Fellow of ACI | Loov, R.E. | Elected Fellow of CSCE |
| Ward, M.A. | Gave invited short course on utilization of fly ash West Virginia Univ., Morgantown, Aug. 13-16 | Dilger, W.H. | CSCE's P.L. Pringle Award (with G.S. Tadros and G. Ghoneim) |
| 1978 Joshi, R.C. | Six invited lectures at COMPA Int. Pty. Ltd. 'Teach-In' Singapore, Aug. 28-30 | Ghali, A. | Elected Fellow of ACI |
| | President, Alberta Chapter of ACI | Joshi, R.C. | Elected Fellow of ASCE |
| Loov, R.E. | Circular Storage Tanks and Silos' E. & F.N. Spon. Ltd. London. & John Wiley & Sons, N.Y. | Sargious, M.A. | Elected Fellow of ACI & ASCE |
| Ward, M.A. | | Wirasinghe, S.C. | Co-Editor-in-Chief of J. Adv. Transp. Research Fellowship Japan Society for Promotion of Science |
| Ghali, A. | | 1990 Joshi, R.C. | Elected Fellow of CSCE |
| Gillott, J.E. | U.S. Patent 'Improvement in Sulphur Concretes, Mortars and the like' | Sargious, M.A. | Assoc. of Commonwealth Universities |
| Jordaen, J. | | Wirasinghe, S.C. | Gordon and Jean Southern Development Fellowship |
| Loov, R.E. | | 1991 Dilger, W.H. | Izaak Walton Killam Memorial Prize for 1991 |
| Shrive, N.G. | | Johnston, C.D. | ASTM's Certificate of Appreciation |
| Irons, B.M. | Techniques of Finite Elements Ellis Horwood Ltd. (with S. Ahmad) | | |

Table 4.4 LIST OF ACADEMIC AND SUPPORT STAFF — 1966-91
DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC STAFF

| | | | | | |
|----------------|----------------------|-----------------|----------------------|-----------------|------------------------|
| Bloor | 1968-1975 | Hamilton, A.B | 1969-1972 | McArthur, R.H | 1954-1966 |
| Brown, T.G | 1977-present | Harrison, D.G | 1968-1972 | McMullen, A.E | 1967-1993 Emerit '93 |
| Cheung, Y.K. | 1967-1974 | Hartman, F.T | 1991-present | Mills, R.H | 1966-1969 |
| Chia, C.Y | 1969-1993 | Hope, B.B | 1965-1967 | Morrall, J.F | 1971-present |
| Chowdhury, K.L | 1972-1976 | Huizer, A | 1969-1991 Emerit '91 | Muzik, | 1978-present |
| Clyde, D.H | 1966-1969 | Irons, B.M. | 1974-1983 | Neville, A.M. | 1963-1969 |
| Day, R.L | 1983-present | Jessop, F.L | 1976-1986 | Rokosh, S. | 1976-1981 |
| DePaiva, H.A.R | 1961-1992 Emerit '92 | Johnston, C.D | 1967-present | Ross, G.A | 1968-1975 |
| Dilger, W.H | 1966-present | Jordaan, J | 1969-1988 | Sargious, M.A. | 1968-1990 Emerit '90 |
| Gamble, B.R | 1968-1985 | Joshi, R.C | 1977-present | Shrive, N.G. | 1975-present |
| Ghali, A. | 1965-present | Karney, B.W | 1985-1987 | Stillwell, W.H. | 1957-1964 |
| Gifford, P. | 1977-present | Kuhlemeyer, R.L | 1969-1993 | Tadros, G.S | 1970-1988 |
| Gillott, J.E | 1970-1993 Emerit '94 | Langan, B.W | 1965-present | Ward, M.A | 1965-1993 - Emerit '94 |
| Glockner, P.G | 1958-1994 Emerit '94 | Loew, R.E. | 1963-present | Wirasinghe, S.C | 1976-present |
| Gysi, M. | 1973-1983 | Manz, D.H | 1983-present | | |

SUPPORT STAFF

| Secretarial | | Technical | |
|------------------------|--------------|------------------|--------------|
| Anand, S. | 1991-present | Anson, D.F | 1980-present |
| Branson, V. | 1978-1980 | Clarke, C.J | 1986-present |
| Cave, K. (Friesen) | 1970-1976 | Damson, E.L | 1967-present |
| Croger, L. (Irons) | 1973-1975 | Gazsi, J. | 1968-1978 |
| Dawson, M. | 1985-1986 | Huizer, A. | 1967-1969 |
| Devlin, S. (Jamniczky) | 1967-1968 | Hume, D. | 1968-1984 |
| Diewold, S. | 1971-1979 | Johnson, H. | 1968-1988 |
| Donaldson, G. (Hofdy) | 1969-1972 | Juigalli, J. | 1980-1981 |
| Douglas, P. | 1968-1969 | Jhenen, F.N | 1987-present |
| Enrickson, N. | 1976-1978 | McCullough, D.E | 1976-present |
| Fahrenstich, K. | 1970-1971 | MacGillivray, J. | 1974-1976 |
| Hanoski, D. | 1977-1982 | McKellar, M. | 1977-1979 |
| Hawrys, E. | 1968-1971 | Nail, T.F. | 1966-present |
| Hillman, V. | 1967-1968 | Palen, F. | 1981-1984 |
| Jones, M. (Barzilay) | 1984-1987 | Pflaum, G. | 1984-1986 |
| Kadach, R. (Wollin) | 1987-present | Pollard, R.H | 1984-present |
| Kolyk, C. | 1982-1983 | Quinn, T. | 1986-present |
| Landers, L. | 1977-1978 | Rutherford, J. | 1981-1983 |
| Larkin, C. | 1978-1985 | Sidorsky, A.B | 1990-present |
| Leduchowski, S. | 1973-1974 | Tillemann, D.D | 1975-present |
| MacArthur, C.I | 1983-1993 | Tingley, W. | 1963-1969 |
| Maki, L. | 1969-1970 | Tonhauser, J. | 1969-1979 |
| Marshall, M. | 1974-1989 | Turcotte, G. | 1982-1986 |
| McEachern, J. | 1975-1977 | Vaclavik, Z. | 1969-1972 |
| McLellan, J. | 1967-1974 | Westerbeek, E. | 1967-1980 |
| Meulenbeid, T. | 1967-1968 | Wylie, S. | 1969-1973 |
| Foot, J. | 1968-1971 | | |
| Schab, B. | 1968-1971 | | |
| Scott, V. | 1975-1984 | | |
| Sherman, P. | 1982-present | | |
| Takaoka, K. | 1985-present | | |
| Valstar, W. | 1989-1990 | | |

A Place of
Ingenuity

V.

Department of
ELECTRICAL
AND COMPUTER
ENGINEERING

THE SILVER ANNIVERSARY

By decision of the General Faculty Council on Dec. 13, 1990 reported to the Board of Governors on March 14, 1991, the Department of Electrical Engineering became the *Department of Electrical and Computer Engineering*. The Department's increased activities in Computer Engineering education and research thus became more visible. A BSc with a *Computer Engineering Minor* had been introduced in 1981 which proved to be extremely popular and resulted in steady growth both in terms of undergraduate enrollment as well as academic and support staff. Electrical and Computer Engineering became the largest Depart-



Plate 5.1 The secretarial staff in Electrical and Computer Engineering. L to R: E. Lok Fraser, T. Patterson, V. Reinelt, A. Rundle, L. Peshke (seated) 1991

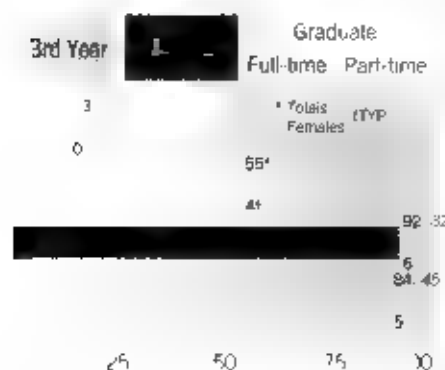


Fig. 5.1 Registration Statistics - Fall 1990. Electrical and Computer Engineering with Computer Engineering Minor shown in *italics*.

ment in the Faculty during the period 1986-91.

During 1990-91 the Department continued to operate with record undergraduate and graduate student enrollments producing bumper crop graduating classes. There were 251 students registered in the various programmes in Electrical and Computer Engineering including 176 and 57 full-time and 3 and 13 part-time undergraduate and graduate students respectively, as well as 2 Diploma students. Two of the graduate students were registered in the newly approved International Coop Programme. In addition there were 13 PhD, 40 MSc and 2 MEng full-time and 12 MEng and 1 MSc part-time students in the Department. Of

the full-time students 11 and 4 were females registered in undergraduate and graduate programmes respectively. The popularity of the Computer Engineering stream is underlined by the third and fourth year registrations. In a third and fourth year class size of 84 and 92 respectively there were 45 and 32 Computer Engineering students (see Fig. 5.1).

The strength of the Department is also indicated by the 90 Electrical Engineering graduates during 1990 including 75 BSc, 2 Diploma, 12 MSc and 1 MEng degree recipients.

Of the 75 *baccalaureates* 7 were with distinction, 7 were awarded to women, and 27 were in the Computer Engineering Minor (see Fig. 5.2). One of the students graduating with distinction, Brandon John Frey, won the ECE Engineering Student of the Year Medal as well as the APEGGA Gold Medal for 1990 in Electrical Engineering. These statistics are reinforced by the June 1991 Convocation figures which indicate 71 BSc degree recipients, of whom 4 were women, and 8 graduated with distinction. One of those eight, Christopher John Kuchach, won not only the APEGGA Gold Medal, but



Plate 5.2 The technical staff in Electrical and Computer Engineering. L to R: standing G. Hancock, R. M. Thomson, W. S. Farnham, A. E. Nordquist, P. Walsh (seated), E. G. Evans, G. Schmitt 1991

also the Governor General's Medal and the Marie Kovitz Prize (see Plate 25). There were also 7 graduate degrees awarded to Electrical Engineering students in June 1991 including 1 PhD, 5 MSc and 1 MEng degrees with 1 of the MSc graduates being female.

In addition to the regular Electrical and Computer Engineering undergraduate third and fourth year programmes, the Department offered 22 graduate courses during the academic year 1990-91. This heavy teaching load was carried by 24 full-time and 7 part-time staff, the full-time complement of which included one instructor and 23 professorial appointees.

The strength of the Department is particularly underlined by its research activities and research output. During 1990-91, the academic staff in the Department were successful in attracting \$2.1 million in external research grants and contracts, including \$0.35 million in equipment grants. They published over 70 papers and reports, 24 of

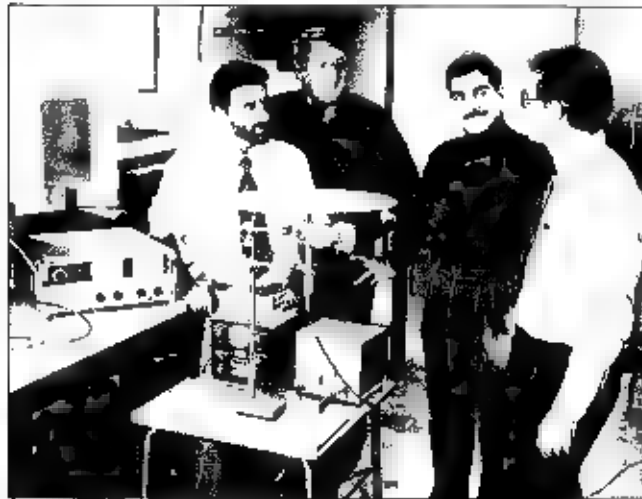


Figure 5-4 Four members of the Communications Group in the Microwave Laboratory are discussing radiation and its problems related to inducing propagation. The equipment on the table is used to generate an 800 MHz signal, which is directed into the room by a monopole antenna, joining it from the flat horizontal disk. To reduce interference to reception due to reflection within the room, EM electromagnetic wave absorbers are used along the top shelf of the work benches. The receiving antennas are designed and optimized by students. Left to Right: Dr. C. Wayne-Hallway, S.T. Nichols, M. Fattouche, and R.H. Johnston. (JPL)



Plate 5.3 The Biomedica: Engineering Group in the Biopetronic Laboratory with Ms. Suden, Ms. Sheng L. & R. Drs. R.A. Stein, R.M. Rangayyan, K.V.S. Kaler, Dr. Kaler and his associates and students are involved in research in biological dielectrophoresis, DEP which led to the design and fabrication of a patented levitator system used in separating frequency dependent dielectric properties of individual intact cells. The work which is supported by grants from NATO/Mediconica Canada etc. the Alberta Government and NSERC, has applications in various biotechnology fields including electrofusion and sensors. © 99.

which were refereed journal papers. An outstanding highlight for the Department, the Faculty and the University was the awarding of the Ernest C. Manning Prize to Dr. Len Bruton for his contributions to

electronic filters
(see Plate 211)

Len Branton also spearheaded the application which led to the establishment of the

Calgary Center of MICRONET a Node on the Federal Government sponsored Network of Centers of Excellence on Devices, Circuits and Systems for Ultra Large Scale Integrated Circuits. Two major equipment grants, one from the Canadian Microelectronics Corp. and another from NSERC helped the VLSI Group establish

| Education Level | Percentage of Females |
|-----------------|-----------------------|
| BSc | ~15% |
| PhD | ~75% |
| MSc | ~45% |
| MEng | ~35% |
| Dipl | ~25% |

Fig. 5.2 Convocation Statistics 1990
Electrical and Computer Engineering
with Computer Engineering shown in italics

new VLS Laboratory (see Plate 2.12) involved in these research and teaching activities were 3 visiting scholars, 5 post-doctoral fellows, 10 research associates, 8 technicians and 6 secretarial staff (see Table 5.1 and Plates 5.1 and 5.2).

The depth and breadth of the Department's research is most apparent from its large number of specific research groups. There are 8 such groups, one for each of the areas of Communications, Computer Engineering, Controls, Electronics and Instrumentation, Power Systems, Signal and Image Processing, VLSI Design and Biomedical Engineering. The assignment of staff members to one of these groups is somewhat

arbitrary since a staff member might be active in several research areas spanning the research domains of several groups. Consequently, several staff members are listed in more than one group even though they may appear only on one of the eight plates depicting research groups within the Department.

During 1990-91, the following research groups with specific research objectives were active in the Department of Electrical and Computer Engineering:

- the Biomedical Engineering Group, a Sub-Group of the 16 member Faculty Biomedical Engineering Group, including Drs. K.V.I.S. Kaizer, R.M. Rangayyan, M.R. Smith and R.A. Stein were involved in research dealing with biomedical instrumentation, magnetic resonance imaging, MRI, dielectric properties of biological cells, electrical stimulation of soft tissues, coding and transmission of medical images for tele-radiology, biomedical signal and image processing and enhancement including knee joint and heart sound signal analysis, mammogram and rigid image enhancement and restoration of medical nuclear images (see Plate 5.3).
- the Communications Group, comprising Drs. W.C. Chan, M. Fatouche, D. Irvine, Ha-day, R.H. Johnston, S.T. Nichols and A. Sesay are working on problems dealing with telecommunications networks, fiber optic

transmission systems, cellular radio, satellite communications, modulation and coding, interference suppression and adaptive filtering. Their work benefits significantly from collaboration with local industry and organizations such as the Telecommunications Research Laboratories, TRIL, formerly the Alberta Telecommunications Research Center, ATRC (see Plate 5.4).

- the Computer Engineering Group, including Drs. J. Gu, G.S. Hope, B. Nowrouzian, M.R. Smith and L.E. Turner are active in computer graphics, computer vision, expert systems and artificial intelligence, computer architectures, data processing, artificial neural networks, software engineering, computer networks, computer aided design, goal oriented languages, emulations and interfacing logic (see Plate 5.5).
- the Control Systems Group, consisting of Drs. W.C. Chan, T. Chen, M.H. Hamza and R.B. Streets are researching problems in optimal, adaptive, nonlinear and variable structure control, parameter identification, microprocessor based control and applications (see Plate 5.6).



Plate 5.5 Two members of the Computer Engineering Group with two of their staff discussing the development of an X-WinX interface using an AMC 9050 RISC microprocessor development system donated by Advanced Micro Devices for California. The group develops peripheral interface experts for the system for DSP and graphics applications. L to R: Mr. S. Zan an graduate student, Mr. R. Smith, Mr. S. Leheim, System Analysts, Jr. 10/10/90

- the Electronics and Instrumentation Group, including Drs. I.T. Bruton, J.W. Haselett, R.H. Johnston, B. Nowrouzian, F.N. Trofimenko and L.E. Turner deal with problems related to analog circuit and device research, noise limitations, micro-electronic active and switched capacitor filter design, CCD imager applications, measurement and instrumentation systems, microwave circuit studies, merged circuit structures, modeling, design and fabrication of very large scale integrated (VLSI) circuits, high temperature behaviour of semiconductor devices and the integration of high temperature data acquisition systems onto single semiconductor substrates (see Plate 5.7).
- the Power Systems Group, comprising Drs. T.H. Barton, G.J. Berg, G.S. Hope, O.P. Malik and N.D. Rao are involved in digital adaptive control and digital protection of power systems, power conditioning, induction motor and synchronous machine studies, expert system applications, transmission planning, optimal state analysis and VAR control, modelling and performance studies of large power systems by simulation (see Plate 5.8).
- the Signal and Image Processing

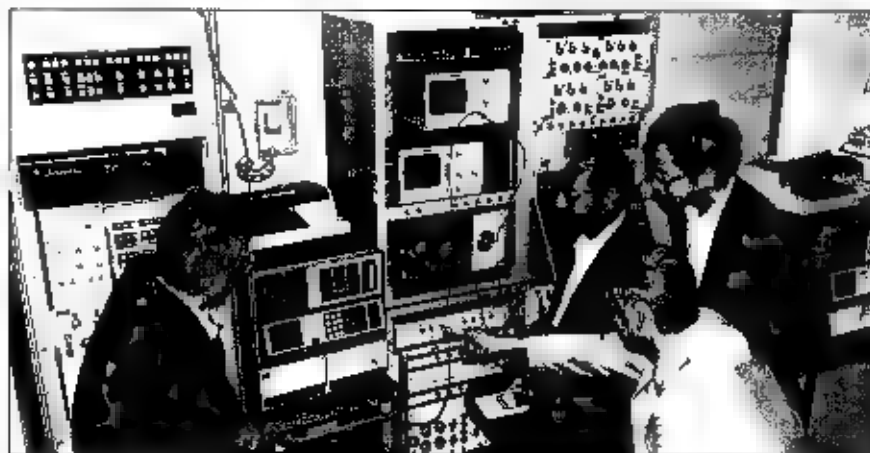


Plate 5.6 The Control Systems Group in the Controls Laboratory are discussing results from the Signal and System Simulator Unit, SSSU. The SSSU is a computer (to the left) and a HF digital Signal Analyser, equipment valued in excess of \$250,000. L to R: Drs. R.B. Streets with their colleagues M.H. Hamza and T. Chen. 10/10/90

Group composed of Drs L.T. Bruton, S.T. Nichols, B. Nowrouzian, M.R. Smith, R.B. Streets and L.E. Turner are involved in problems related to microelectronic active and switched capacitor filter design, digital signal processing, random data analysis, modelling and measurement of random phenomena, identification and characterization, multidimensional digital filter synthesis, microprocessor systems, computer simulation for training of the handicapped (see Plate 5.9).

- the VLSI Design Group includes Drs J. Gu, J.W. Haslett, B. Nowrouzian, F.N. Trolimenkoff and L.E. Turner. The Group's interests lie in system design and



Plate 5.7 Three members of the Electronics and Instrumentation Group troubleshooting one of their integrated circuit designs using a water probe. L to R: Drs J.W. Haslett, L.E. Turner and F.N. Trolimenkoff (seated) - 1991



Plate 5.8 Four members of the Power Systems Group in the Electric Machines Laboratory discussing implementation and testing of a scheme for improvement of induction motor power factors. The research is supervised by Dr. O.P. Malik and involves a graduate student, Mr. Tammakar, whose financial support by CIDA and the World Bank, and training is part of the Nepal Engineering Education Project. L to R: Profs G. Berg, O.P. Malik, G.S. Hoque, N.D. Rao - 1991

verification methodologies, CAD tools, B-CMOS circuit structures, self-testing, multidimensional topological logic partitioning schemes, intelligent compilation and the design and fabrication of analog and digital VLSI and ULS circuits (see Plate 2.12).

The financial support (equipment grants, donations and loans provided by industry, notably the Alberta Microelectronic Center and the Canadian Microelectronics Corporation) as well as collaboration with local industry and organizations such as the Telecommunications Research Laboratories, TRL, have been invaluable for the initiation, support and execu-

tion of research projects in a number of these areas.

During the past few years, there has been a dramatic increase in interaction with external agencies and industry. To illustrate this interaction and the degree to which the research carried out in the Department leads to technology transfer, one might mention the solid state high resolution optical position sensor which was developed during 1990 and was distributed to six Canadian universities for use in various research projects.

The industrial partners in the NSERC MICRONET play a significant part in the transfer of technology resulting from research in signal and image processing. The Telecommunications Group continually interacts with the various industrial sponsors of the TRL. Clearly, the Department has open channels and interacts extensively with industry particularly in the microelectronics, telecommunications and signal processing areas providing steady royalty income to the Department and the University from licensed instrumentation technology transfer.



Plate 5.9 Three members of the Signal and Image Processing Group discussing hardware prototyping for digital signal processing algorithms. L to R: Drs S.T. Nichols, B. Nowrouzian and L.T. Bruton (seated) - 1991





VW ca 1970

A LATE START

One of the main causes of Electrical Engineering's *late start* was the staged construction of the Engineering Complex, extending over a five year period. In accordance with the *Govier Blueprint* and subsequent developments and construction scheduling, the A-Block was the final stage of the Centre and was completed in September 1968. In contradistinction, the Civil, Chemical and Mechanical Engineering Wings were occupied in the summers of 1964, 1966, and 1967 respectively giving those three departments a 1.4 year *head start* in terms of having their own office and laboratory space and enabling them to plan and establish permanent laboratories for under-

staff. They also meant fewer research grants and less financial support available for graduate students and research personnel which further inhibited growth in graduate and research programmes.

Finally Electrical Engineering was the only Department in the Faculty operating without a Head during the first nine months of its existence and for a further six months with an Acting Head.



F. N. Trofimenkoff



E. R. Fox



A. E. Nordquist

Plate 5.10 The inaugural Electrical Engineering administrative team 1967

Mr. F. W. Jinger was appointed Sessional Instructor in Electrical Engineering for the 1963-64 academic year. In the Fall of 1964, Gunnar J. Berg joined the Engineering team at Calgary and became responsible for the Electrical Engineering portion of the undergraduate curriculum. He was to remain the only Electrical Engineering academic present on the Calgary Campus until July 1, 1966 (see Plate 2.32).

During the Summer of 1965, Gunnar Berg took on supervisory responsibility for the first Electrical Engineering MSc graduate student at Calgary. Alan Gordon Herron, a Calgary resident who had obtained his BSc at the University of Alberta in 1964 and was enrolled in an MSc programme at that institution. At his request, he was allowed to carry out the research for his dissertation on the Calgary Campus. Mr. Herron



W. C. Chan



N. D. Rao



R. B. Streets

Plate 5.11 New academic staff 1967

graduate and graduate teaching and research. Having their own permanent facilities also gave them an advantage in initiating research programmes and in attracting good quality academic and support staff, graduate students and other research personnel.

A second contributing factor to the *late start* was the somewhat slow build-up of Electrical Engineering permanent academic staff prior to 1966 which delayed planning and approval of detailed course outlines for their third and fourth year programmes. It also had a number of additional negative consequences. With fewer staff to supervise students, the graduate enrollment was lagging behind that of some of the other departments. Low staff numbers and few graduate students delayed development and approval of graduate programmes at both the MSc and PhD levels. A sma-

llage of the Engineering Complex was completed in September 1968. In contradistinction, the Civil, Chemical and Mechanical Engineering Wings were occupied in the summers of 1964, 1966, and 1967 respectively giving those three departments a 1.4 year *head start* in terms of having their own office and laboratory space and enabling them to plan and establish permanent laboratories for under-

Prior to July 1, 1966, there was never more than one Electrical Engineering staff member present on the Calgary Campus. During 1957-63 it was Prof. H. R. McArthur, an electrical eng-

ineering graduate from UBC, who looked after the single 2nd year course on circuitry between 1960-63 (see Plate 2.17). When he went on sabbatical leave on July 1, 1963,

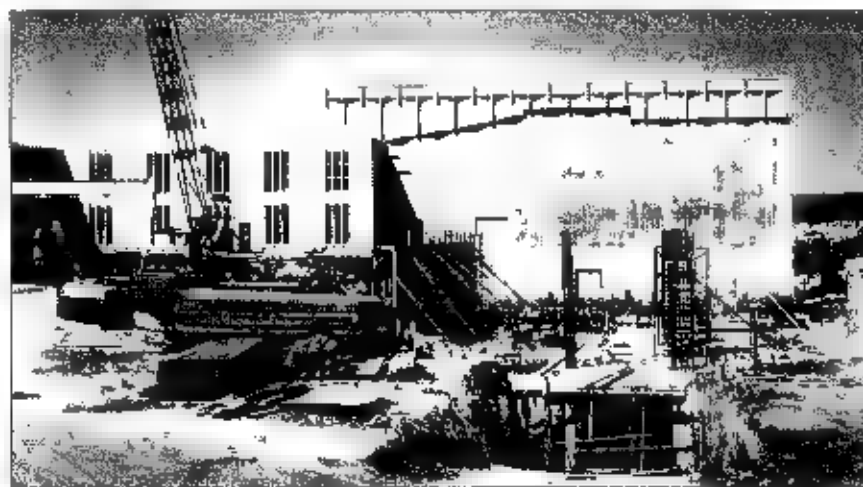


Plate 5.12 A hole in the ground indicates the start on the A-Block during the Summer of 1967, view towards the north

Electrical Engineering 1966-1977

complete his thesis and obtained his MSc degree from the U of A in 1966. In comparison Civil and Mechanical Engineering MSc students were registered in Calgary as Engineering graduate students effective 1963 and 1965 respectively with the first students receiving their degrees at the UAC's 1965 Spring Convocation.

With the arrival of Drs. David J. Comer and F.N. (Fred) Trofimenkoff on July 1, 1966, the Electrical Engineering staff compliment suddenly tripled (see Plate 2.51). Fred Trofimenkoff had known Adam Neville at the University of Sask-



Plate 5.3 Official Opening of the U of C Student Branch of the Institute of Electrical and Electronic Engineers (IEEE) with Mr. David G. Agnew presenting the certificate to Mr. Robert Tanner, Bell-Northern Research Laboratories with Dr. J. D. Lamm, D.W. Hinder, R.W. Jesh, and Dr. S. Agnew, Executive Members of the Branch. Robert Tanner, Director of the Canadian Region of IEEE and G. Berg and F.N. Trofimenkoff were Chairman and Secretary/Treasurer of the Southern Alberta Section of IEEE respectively. May 1968.



Plate 5.4 Some of the early Electrical Engineering secretarial staff. From left to right: Elaine Fox, Stephanie Howard and Agnes Kabatuli. 1968-69.

With two full time and a number of part time graduate students in course, the three young academics designed and offered five graduate courses during the 1966-67 academic year. They also looked after the second year Electrical Engineering courses

and were planning detailed course outlines for the third and fourth year Electrical Engineering programme which had been approved in principle only a year earlier and which was submitted to and was approved by EFC (on Oct. 4, 1966) and GFC. The Head of Electrical Engineering at the U of A, Dr. G.B. Walker, was providing advice in planning our Electrical Engineering curriculum, which was to be a traditional programme designed to provide the appropriate background for electrical engineers entering the oil and gas industry.

chewan in 1962-63. He decided to join the Neville team even though he had to come to a headless department. Of course, he also knew a number of outstanding students at Saskatoon, one of whom, Mr. James W. Haslett, just finished his undergraduate studies in the Spring of 1966. Jim Haslett came to Calgary during the summer and started his MSc work under Fred Trofimenkoff's supervision, thus being the first full time Electrical Engineering graduate student in our Faculty (see Plate 5.15). Two months later Mr. A.K. de Sarkar registered in Electrical Engineering as a second MSc student (see Fig. 5.3). The Department was granted approval for MSc studies in semiconductor devices and electronics and in power systems during late Summer of 1966.

ENGG 303 and 304 which were offered for the first time during that session. In addition, they were in

The Electrical Engineering academic staff the technician, Mr. A.E. (Art) Nordquist, whom Fred Trofimenkoff

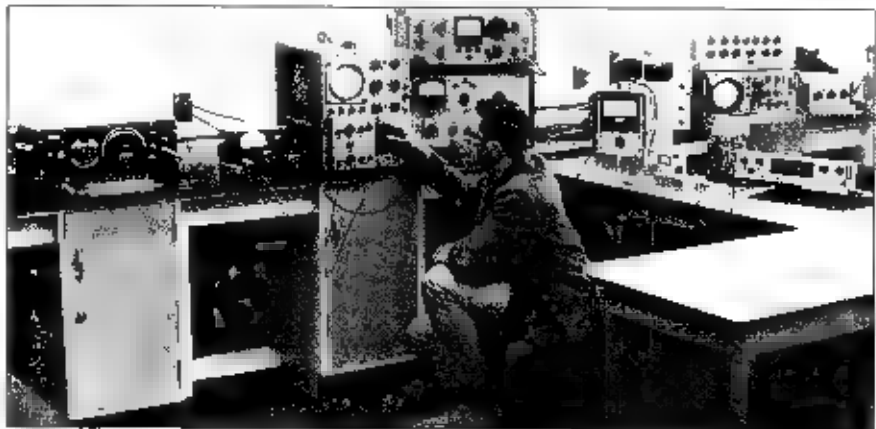


Plate 5.15 Mr. W. Haslett (MSc '68, PhD '70) the first MSc graduate and one of the first PhD degree recipients in Electrical Engineering at the U of C shown here in the Electrical Engineering Laboratory working on noise reduction in electronic devices and circuits. 1968-69.

had known in Saskatoon and was joined the Department on Nov. 1, 1966, and the secretary Mrs. Elthe French were housed in the Civil Engineering Building. The Department occupied some 4,500 ft² (420 m²) of laboratory and office space. The A-Block was in its final design stage with construction to start in early Summer of 1967. Considerable time was spent in planning the laboratories for the third year Electrical Engineering curriculum which was to be implemented in the Fall of 1967. The laboratories were to be housed temporarily in the Mechanical Engineering wing which was under construction with planned occupancy for the Summer of 1967.

On January 1, 1967, Dr. Gordon S. Hope joined the Department (see Plate 2.51). He and the other 3 students were trying to initiate research



E. L. (Dharma) Rao



M. H. (Dharma) Rao



M. H. (Dharma) Rao



M. H. (Dharma) Rao

as best as they could in their temporary quarters in the E-Block and were establishing their presence in the profession. Gannar Br. was active in the Southern Alberta Section of the Institute of Electrical and Electronics Engineers (SAS EEE) serving as Secretary-Treasurer during the 1966-67 academic year. A petition to form an EEE Student Branch at The U of C was submitted (see Plate 5.13) and branch privileges were granted during the 1967-68 academic year.

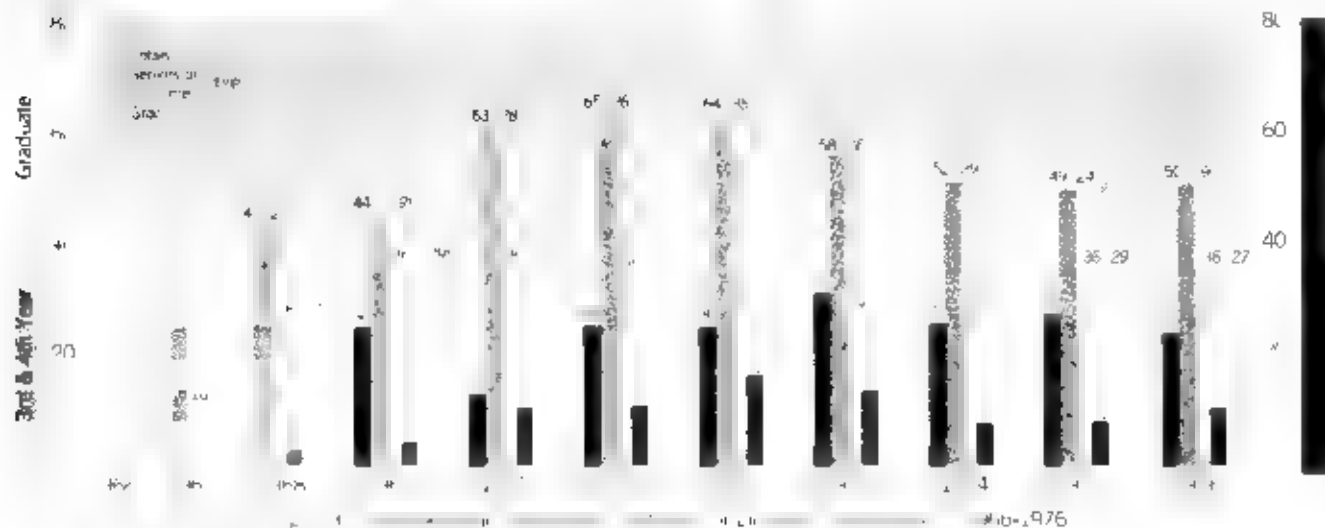
On April 1, 1967, Dr. Fred Trofmenkoff was appointed Acting Head of the Department of Electrical Engineering which signified the start of the *Trofmenkoff Decade* a period of steady growth. Dr. Trofmenkoff had been in the Department soon after his appointment. He finalized arrangements for appointing Dr. R. B. (Bud) Streets as effective July 1, 1967 and Drs. W. C. (B. Char)

and N. D. (Dharma) Rao effective September 1, 1967. He also hired Messrs. Alex M. Phillips and Patrick J. Walsh effective June 5 and July 1, 1967 respectively (see Plate 5.17). A month prior to his appointment he had been instrumental in hiring Miss Elaine R. Fox as replacement for Mrs. Elthe French who had left in January. Miss Fox was to remain the Electrical Engineering Department's Secretary until 1976 (see Plates 5.10 and 5.14).

The search for a senior academic as Department Head of the Department of Electrical Engineering had remained unsuccessful and was intensified after July 1, 1966. By late summer and early fall it became clear that no candidate was available who would be better qualified for this position than the young, talented Fred Trofmenkoff who, although only slightly over 35 years out of his PhD studies, had already established a solid reputation as a capable researcher and had shown himself to be an able and effective administrator during his Acting Headship. His appointment was confirmed on October 1, 1967 for a 5 year period.



Mr. Alex M. Phillips working on a large piece of electrical equipment in the laboratory.





M S Swamy

T. ...

A. Haslett

R H Johnston

J E M. Ker...

N...

B...

...ing the years 1969-70.

The Fall of 1967 saw a further move in the Electrical Engineering academic staff and the secretarial staff move into the newly completed B-Block. The technical staff, graduate students and research laboratories continued to be housed in C-Block Engineering. September 1967 also saw the start of the third year programme. Twenty-seven students were registered in that first Electrical Engineering 3rd year class (see Fig. 5.3). Graduate enrolment was expanding rapidly with the number of full-time MSc students going from 2 in September 1966 to 10 in the Fall of 1967 (see Fig. 5.3). Research grant support also increased rapidly going from \$8,000 the previous academic year to \$43,500 in 1967 (see Fig. 5.4).

The young Department Head realized that any negative effects of the late start to the Department had been dealt with and could only be overcome by attracting outstanding academic and support staff and good undergraduate and graduate students. The Department was successful in hiring Drs. M. H. Hamza, effective March 1, O. P. Malik and R. A. Stein, effective August 1, and B. B. Bhattacharyya, effective

September 1, 1968. In addition, Dr. B. S. Sheehan had joined on a quarter-time basis on July 1, 1967.

Both Profs. Berg and Trofimenko continued their activities in the SAS of IEEE serving as vice-Chairman and Secretary-Treasurer during the 1967-68 academic year, respectively. The Department was awarded the SAS of IEEE Biennial Library Development Grant of \$3,000 (see Fig. 5.4). Prof. Trofimenko was invited to serve on the Electrical Components Research and Development Committee of the Defence Research Board (DRB) an honour which not only recognized his research but also brought visibility to Electrical Engineering at Calgary.

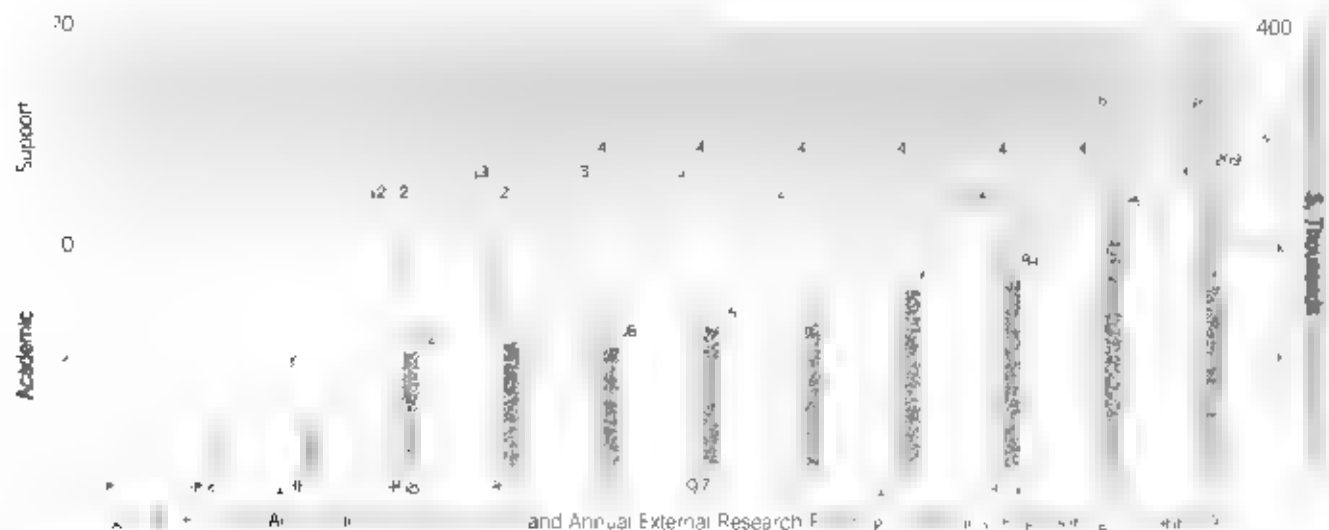
The Department elected to confine its research activities to three areas, namely:

- semiconductor device and circuit studies
- power systems analysis
- control systems and random data processing

During 1967-68, it submitted a request for approval to offer PhD pro-

grammes. These efforts resulted in the Faculty of Graduate Studies giving preliminary PhD approval to the Department in the Fall of 1968, a further sign of confidence in Fred Trofimenko's leadership and the development of the young Department.

The Electrical Engineering Wing was completed in September 1968 in time to start the fourth year programme in the new building with 25 students in that first +B-Block Engineering graduating class (see Fig. 5.3). The enrolment in third year was disappointing 18 students and should have been an early warning sign. The graduate programme, however, was expanding beyond all expectations, going from 6 students in the Fall of 1967 to 26 in the Fall of 1968 including 3 PhD, 17 full-time MSc and 5 part-time MSc students. In addition to Messrs. de Sarkar and Haslett, both of whom continued their studies after their MSc degrees, Les and Paul Dennis registered PhD programmes in September 1968 after completing his MSc at the University of Saskatchewan. A second new graduate student, Mr. Roger



Thomas Pederson came to Calgary from Saskatoon that Fall. Also two of the Calgary students Messrs T.G. Aftenhof and B.R. Bryden came back for graduate work after completing the BSc programmes at the U of A in 1967. Alan Herron returned to register in a PhD programme after being in industry for 2 years.

Bernie Sheehan was full-time Assistant to the Acting President during the Fall of 1968 and full-time Assistant to the Vice President Academic after January 1, 1969. Consequently Professor R.G. Anthes, visiting from the University of Waterloo, was given a Sessional appointment for the period January 1-April 30, 1969.

In the profession Gunnar Berg served as Chairman and Fred Trofimenkoff as Vice Chairman of the SAS of EEE. A \$2,000 donation was given to the Random Data Laboratory Fund by Dr. S. Benda of the Measurement Analysis Corporation.

The most significant change in the Department's daily life after September 1968 was the availability of its own permanent space which allowed all of its components to be brought together in the A Block, vacating the temporary space it had occupied in the Civil and Mechanical Engineering wings. This change allowed the Department to start establishing much needed permanent laboratory facilities including undergraduate and graduate electronics and power systems laboratories, undergraduate control systems and microwave laboratories and a control systems and random



Picture 5-9 M. D.A. Berts in the random vibrations & control laboratory with the digital counter which integrates and averages EEE signals, mounted on the desk in the random area in the fall of 1970.

data processing laboratory for post graduate studies and research. These new laboratories demanded additional manpower and technical support staff were hired with Art Nordquist being appointed Technical Supervisor. The number of secretaries was increased from 3 to 4 (see Fig. 5-4).

The Spring of 1969 saw the first Electrical Engineering graduating class with 24 students receiving their BSc degrees, 5 of whom graduated with distinction (see Plate 5-42). Exactly one third of the graduating class, namely Messrs Ben Colquhoun, Hubert Jamniczky, Lee Marriott, Prater and Sma wood decided to stay on to do graduate work for an MSc degree.

Dave Comer resigned effective August 31, 1969. To replace him Dr. M.N.S. Swamy was appointed effective July 1, 1969. Dr. Swamy came from Concordia University in Montreal and brought with him his PhD student Mr. John Walsh, hailing from Nova Scotia.

The graduate and research programme of the Department continued to expand very rapidly with graduate student enrollment in the Fall of 1969 climbing to 36 including 14 PhD, 15 full-time MSc and 7 MEng students. External research support reached \$111,000. Undergraduate enrollment on the other hand remained static with 44 students including 19 seniors (see Figs. 5-3 and 5-4).

Only a few months after his arrival Professor Swamy decided to return to Concordia and resigned, effective July 1, 1970. Dr. Bhattacharyya followed suit. Bernard Sheehan became Director of the Office of Institutional Research (OIR) and also resigned effective July 1, 1970. Fortunately, the Department was able to hire a number of outstanding young academics including Drs. R.H. Johnston, on January 1, 1970, Drs. L.T. Brown, J.E.M. Kendra and S.T. Nichols effective July 1, 1970. W. Haslett completed a PhD degree requirements and defended his thesis in June 1970. He was also appointed effective July 1, 1970.

During the 1969-70 academic year Fred Trofimenkoff was Chairman of the SAS of EEE with Gunnar Berg serving as past Chairman. Gordon Hope came on board as Vice Chairman during Fred's term as Past Chairman. From then on, for the next 5 years, Gordon Hope, Om Malik and Ron Johnston succeeded one another in these executive positions, each of them serving for 3 years. The year Ron Johnston retired as past Chairman, Jim Glchrist took on the task of Secretary-Treasurer of the SAS of EEE (1976-77). For over 10 years, at least one academic from the Electrical Engineering Department was a member of the Executive of this organization.

Although less than 2 years old, renovations were carried out in the A Block during 1969-70 to create badly needed office space for Civil and Chemical Engineering staff for



Picture 5-20 M. Arthur Petter with his MSc 1973 EEE L.F. Hickey left Prize winner on the best water meter of 1973 is shown here during readings on a water metering machine in 1974.

Appointed Prof. Appointed Assoc. Prof. Appointed Assoc. Prof.

The Fall of 1970 saw a sudden increase in third year enrolment (see Fig. 5.3) which continued for two years. Unfortunately by 1973 a downturn in undergraduate enrolment set in which lasted for the rest of the decade and kept Electrical Engineering undergraduate numbers lagging behind all other departments in the Faculty. And these low enrolments were not for lack of effort on the part of the Department Head and his academic colleagues. It was the Electrical Engineering professors who won the Outstanding Teacher Awards. First David Comer won the University Outstanding Teacher Award in 1969. Then John Kenzler won the American Society of Engineering Education (ASFE) Western Electric Prize for excellence in undergraduate teaching for the year 1976. But outstanding teaching did not affect the number of students entering Electrical Engineering significantly nor did changes in third and fourth year Electrical Engineering programs whereby the Department strengthened the control system and digital systems components of the cur-

Graduate student enrolment also seemed to have peaked around 1970-71 (see Fig. 5.3). The reputation of the Department's graduate and research programmes, however, continued to grow both nationally and internationally, attracting an increasing number of research associates and postgraduate fellows from around the globe. Members of the Department were also very successful in sponsoring visits of foreign colleagues through the Canada Council Cultural Exchange Fellows Program which brought to Calgary such researchers as Drs. W. G. Runggaldier from the University of Padova (Italy) in 1971, Peter Kalbfleisch, Director of the Institute of Operations Research at the University of Zurich, in the Fall of 1972, Gunther Schmidt of the Technical University of Munich in the Summer of 1973 and Dr. S. C. Shmelev, staff member of the Moscow Power Institute, during 1974-75.

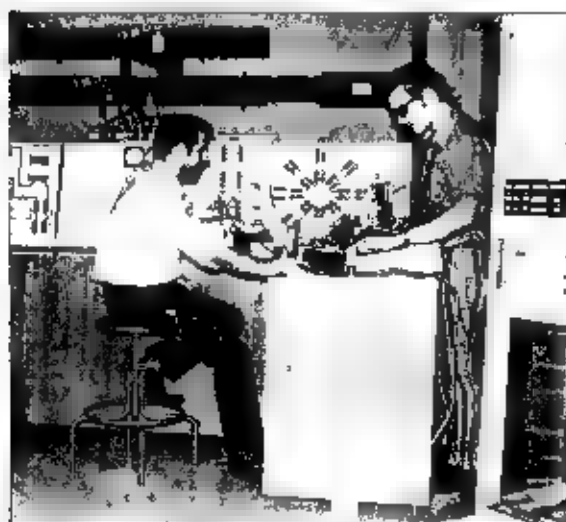
During this period the Department decided on developing an MSc core course programme according to which a MSc student had to take 2 out of a set of 3 graduate courses. This common provision was reviewed and was revised in 1975/76 to increase the number of required courses to 3 out of a set of 4.



with Mr Douglas H B-
playing y... inversion

As Fred Trofimenkoff had correctly predicted in a 1972 memo to Dean R. A. Ritter, the Department's research activities became more and more application oriented and supported by university and governmental programmes designed to foster industry-university cooperation. Some of the outstanding research activities and projects during the 1972-77 period include the following:

- Dr L.T. Bruton's innovative research on electronic titers initiated at Newcastle during his PhD studies and first published in 1969 was being recognized by



Power Systems/Electrical Machinery

the profession and by such industry leaders as Northern Electric Co., Hewlett Packard Co. and GTE Lenkurt Bell Northern Research Laboratories. BNR designed a new filter in 1971-72 for Northern Electric's new DIGITONE receiver in which the Bruton frequency dependent negative resistor (FDNR) was used (see Plate 5.26). H.P. used the FDNR in a front end design to digital analysis equipment and GTE Lenkurt California were producing micro-electronic FDNR filters and acknowledged the originality of Len Bruton's invention for which he was awarded the 1991 Ernest C. Manning Prize (see Plate 2.11). A \$38,000 PRA (Project Related Assistance to Industry Grant April 1973 - December 1975) supported further research on electronic filters by Dr Bruton's group. Funding was also obtained from DRB (\$15,000 over a 3 year period).

- A digital filter by Len Bruton found application in seismic signal processing; the research for which was supported by a 3 year contract with Seis and Associates (\$19,500). The aim of this work was to produce improved signal and image processing algorithms which would provide higher quality images of oil and gas reservoirs than those which were attainable from previous programmes. This initial study led to a major contract (to be discussed in the next Section).

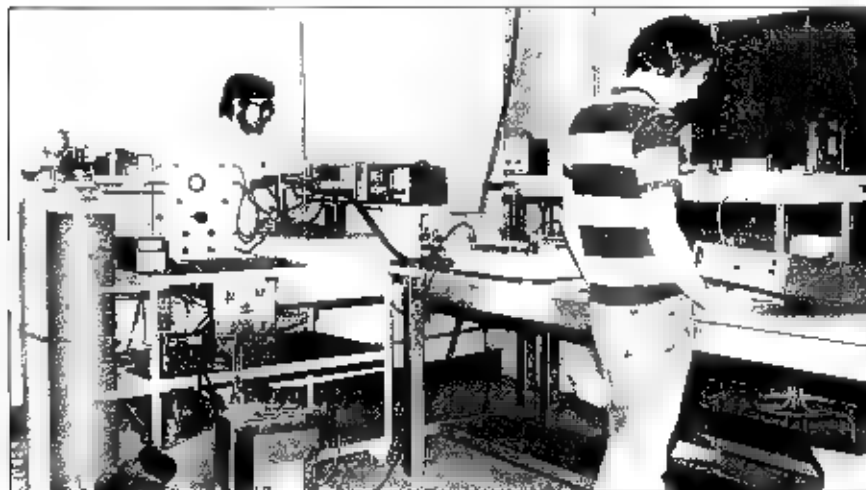


Figure 4: B. T. Nichols (left) and M. E. G. King (right) working on electronic filters (right) at Seis and Associates, 1973-74.

- Initial contact between Alberta Government Telephones (AGT) and the Department occurred in 1972-73 when they requested Dr. S.T. Nichols to carry out a study on the fading of microwave signals between two consecutive microwave towers in the Edmonton area (at Sherwood Park and Nisku) for which they awarded him a \$5,400 grant. This initial contact eventually developed into a long standing continuous interaction between AGT and Electrical Engineering at The U of C and

ultimately resulted in the establishment of the AGT Communications Professorship. AGT was also interested in a continuing education programme for the engineers which led to a series of short courses offered through the Faculty of Continuing Education between 1972 and 1977, a programme which was organized by S.T. Nichols and involved more than half of the Electrical Engineering staff, including Drs Bruton, Chan, Gichrist, Hasett, Hope, Johnston, Kendal, Nichols and Streets. These activities fostered good relations with AGT.

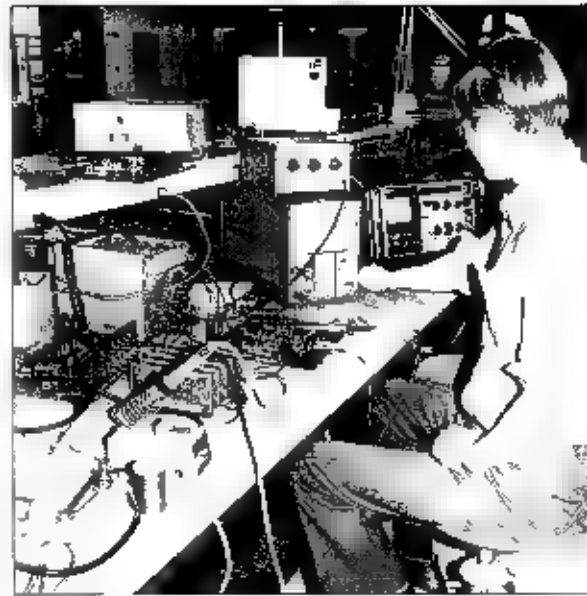


Figure 5: Arnold Pettersson, MSc '71, MEd '73, working on a large electronic circuit board.

- Mr. Arnold Pettersson (BSc '71, MSc '73 (see Plate 5.20)) and his supervisor, Dr. Gordon S. Hope, were recognized at the IEEE White Power Engineering Meeting in New York February 1972 for the work on power system parameter identification by means of on-line computer analysis of frequency gain and frequency phase characteristics of signals. Arnie Pettersson was selected as the 1972 Hinkley Prize and Award recipient for the best student paper in the international competition. The \$500.00 Prize was provided by the Anaconda Wire and Cable Company. Gordon Hope was presented with a plaque by IEEE's Power Engineering Education Committee for inspiring A. Pettersson to present the prize winning paper. Arnie's initial studies on DC systems was subsequently extended by him to AC networks and mechanical systems through a PRA Grant to Drs. G.S. Hope and S.T. Nichols (\$14,100 April 1974 - May 1975). Implementation and testing of the method on a actual power system was carried out in cooperation with the Saskatchewan Power Corporation at their power station at Squaw Rapids in Northern Saskatchewan.

- A second power systems project involving 3 students, Messrs. Ken Runtz, Dennis Huber and Ahmad

Farag and supervised by Drs. G. S. Hope and O. P. Malik involved the development of a centralized digital computer control system for power distribution networks. The new system, which replaced conventional large voltage regulators, was more efficient and required less time to operate. It was more easily monitored and facilitated the introduction of new control techniques. It also provided a means for a centralized computerized regulating system. It was this initial work on power voltage regulation which led to the development of international collaboration between the Power Systems Group at The U of C and similar groups in the USSR and China. In 1978 Drs. G. S. Hope and O. P. Malik were awarded a special fellowship under the Canada-USSR Scientific Exchange Program. An Agreement was then signed between the two countries to work on power generating and distributing facilities.

- In the Spring of 1974 Mr. Robert Wilson of the Canadian Services Laboratory in Ottawa, Ontario, contacted Dr. W. H. Hsieh and F. N. Trimmer to see whether they would be interested in trying to

design an electronic equivalent to existing mechanical recorders used in determining temperature and pressure variations in oil and gas producing reservoirs. The instrumentation system would have to withstand a temperature range from -10 to $+25^{\circ}\text{C}$ and pressures up to 15,000 psi. A feasibility study indicated the feasibility of the instrumentation system. Funding was obtained by Lynes Limited under the Federal Government's PAIT (Program for the Advancement of Industrial Technology) Program in the amount of \$121,000 Jan. 1975 to Jan. 1977. The major portion of the fee was contracted to the Trotenkol-Hall research team which after two years of development and testing developed a prototype DMR/DSR system (see Plate 5.25). In addition, the two principal investigators, the research team included the following:



Fig. 5.24. Mr. Robert Wilson, Mr. W. H. Hsieh and F. N. Trimmer with the prototype DMR/DSR system. The system is a microprocessor-based system which is used in the drill stem and powered to the geological zone to be monitored. The system monitors temperature and pressure variations in the reservoir from which oil is produced and the rate of flow of gas reservoir are determined quickly and accurately (ca. 1



Fig. 5.25. Dr. G. S. Hope, Dr. O. P. Malik, Dr. F. N. Trimmer and Mr. Robert Wilson with the prototype DMR/DSR system. The system is a microprocessor-based system which is used in the drill stem and powered to the geological zone to be monitored. The system monitors temperature and pressure variations in the reservoir from which oil is produced and the rate of flow of gas reservoir are determined quickly and accurately (ca. 1

Messrs. R. E. Sma wood and A. B. D. Safford, former and present graduate student respectively, three undergraduate research assistants, Messrs. P. James, B. Cassidy and R. E. Kovach, and two technical assistants, Messrs. A. M. Phillips and G. S. Fritz. At the 1978 International Petroleum Technology Conference (IOTC) in Houston, this instrument system was selected by a panel of oil and gas industry experts as the winner of the 1978 Annual IOTC Special Meritorious Award for innovation in concept, design and application.

In addition to such contract and government industry supported research projects, the academics in Electrical Engineering were successful in increasing their external research grant funding and obtaining major equipment grants, thereby improving and building the Department's experimental facilities for graduate and undergraduate teaching and research (see Fig. 5.24).



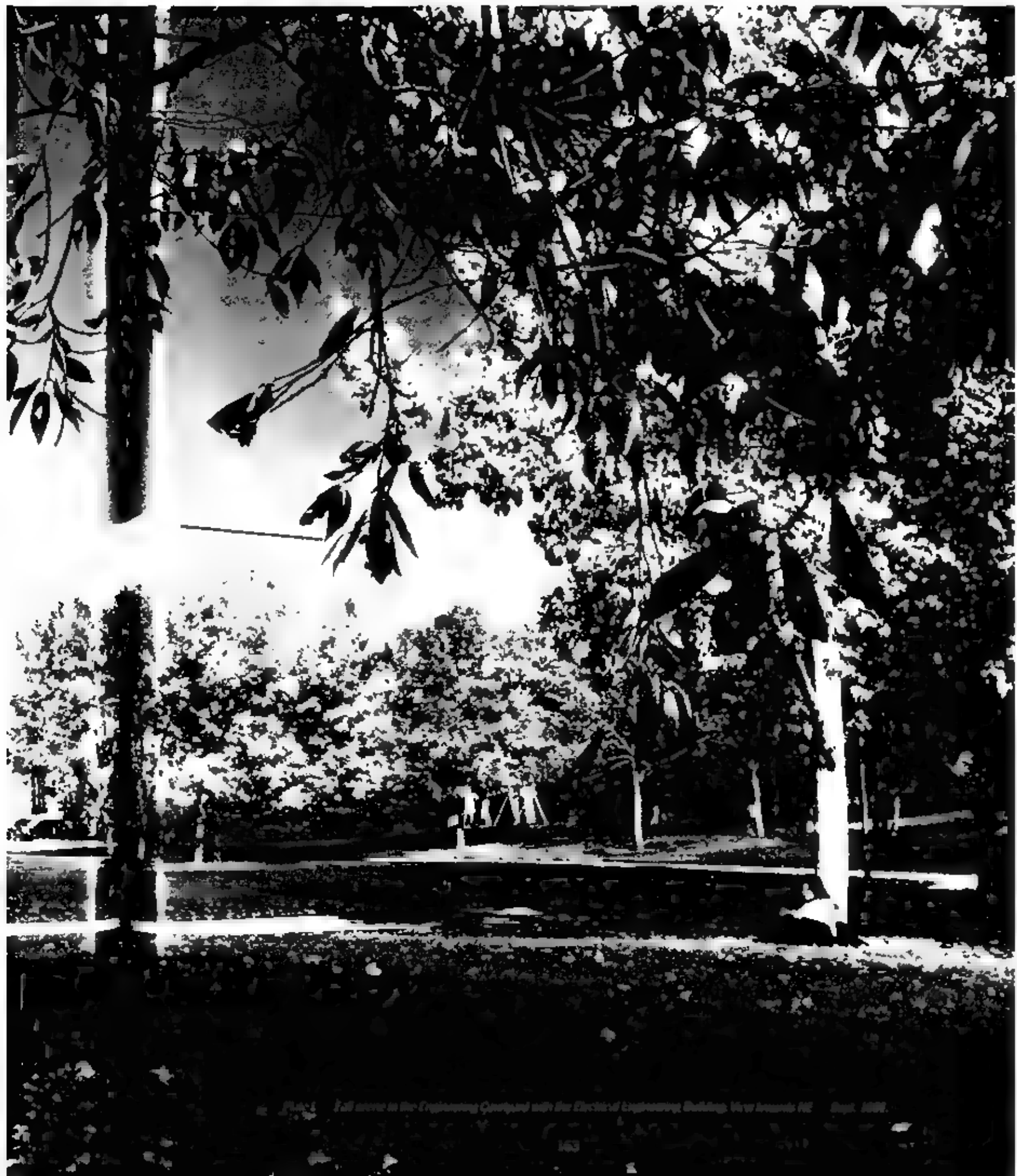


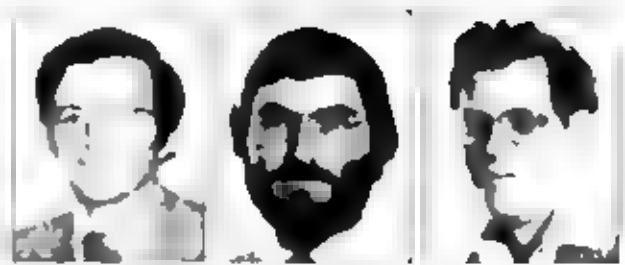
Fig. 1 Fall scene in the Engineering Quad with the Electric Engineering Building, New Haven, CT Sept. 1989.

THE MAGIC OF COMPUTERS

Introduction of the Computer Engineering Minor in September 1981 was to date, the most momentous development in the Department of Electrical Engineering with significant faculty wide repercussions. Implementation of this special programme package was spearheaded by Dr. L.T. (Len) Bruton who became Fred Trofimenkoff's successor on July 1, 1977. The motivation for the Minor came, at least in part, from the Department's concern for its *training position* in the Faculty with regard to undergraduate enrolment. As if to highlight the problem for the incoming Head at the Spring Convocation on June 10, 1977 Electrical Engineering had the lowest number of BSc graduates of any Engineering department and with only 14 students receiving their degrees had hit an all time low for itself (see Fig. 5.5).

The new Head made it his mandate to try to increase the undergraduate enrolment in the Department. Already during his candidacy for the headship he stated that if appointed he would, at the earliest possible date, introduce a Computer Eng-

neering programme which he felt would increase the enrolment in Electrical Engineering significantly over current and past levels. After taking office, he set about implementing his mandate and his suggestion. With strong support from the Department he initiated negotiations almost immediately with the Department of Computer Science for a joint Computer Engineering programme. Within the Department, lengthy and lively discussions were focussed on whether a full fledged BSc programme in Computer Engineering with a separate Department and substantial associated manpower and space requirements or a less ambitious and more likely realizable programme package referred to as a Minor in Computer Engineering should be proposed. Dealing with the Department of Computer Science also required time, patience and skilful diplomacy to achieve the desired goal.



L.T. Bruton

L.E. Turner

M.R. Smith

Plate 5.27
The second Head of Electrical Engineering with new appointees

Plate 5.27
The second Head of Electrical Engineering with new appointees

Finally, after almost 2 years the Department had established a programme proposal which it took to Faculty Council on May 31, 1979 asking for approval of a *Minor in Computer Engineering*, to be offered in the Department of Electrical Engineering with the collaboration of the Department of Computer Science. The proposal was approved by EFC, ultimately gained institutional approval and was funded by the Government in the form of a special 4 year programme development grant effective September 1981. Details of the preparation, submission, approval and implementation of this programme package is briefly summarized in Appendix G.

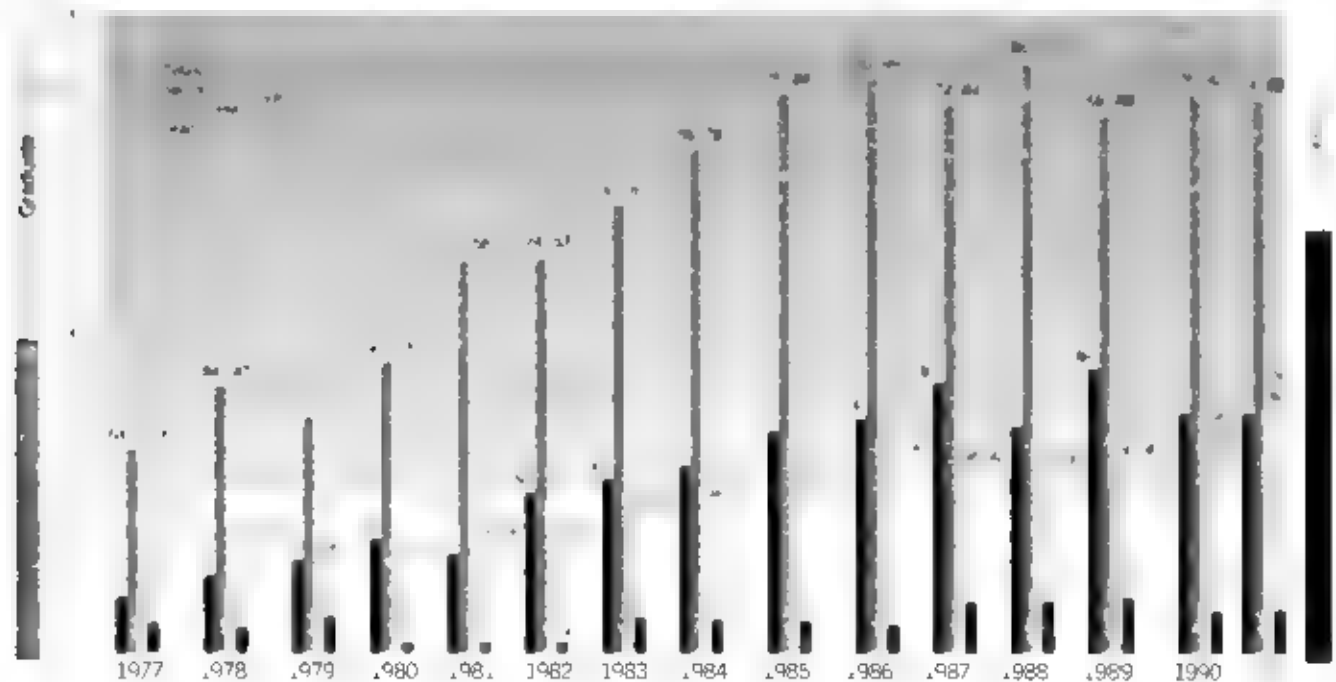


Fig. 5.5 Enrollment and Convocation Statistics for Electrical Engineering 1977-1990.

Electrical and Computer Engineering – 1977-1991

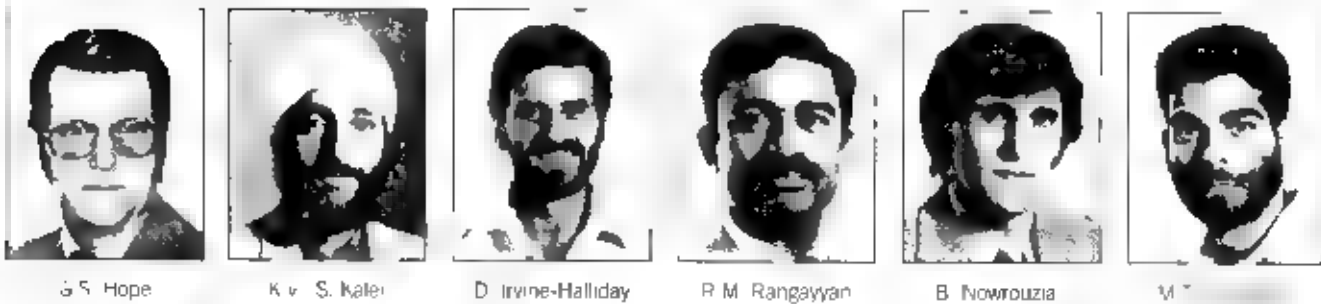


Plate 5.28 The third Head of Electrical Engineering with new staff members

News of the development of a Computer Engineering option in Electrical Engineering quickly spread amongst our undergraduates. Already in the Spring of 1980 the number of second year students opting for Electrical Engineering rose sharply so that the Department was operating close to its enrollment quota during the 1980-81 academic year for the first time in its history. Announcement of the approval of the Minor and its implementation in September 1981 had even a greater impact. So large was the demand for entrance into the Computer Engineering programme in the Spring of 1981 that the Department quickly decided to increase its quota for the Minor from 20 to 30 students.

Popularity of the Minor has surpassed all predictions and expectations. Its introduction suddenly and dramatically increased the number of undergraduates electing to go into Electrical/Computer Engineering, a trend which continued throughout the

1980's, changing radically the distribution of undergraduate departmental enrolments within the Faculty in favour of Electrical Engineering. It was the students' fascination with computers and computing, *the magic of computers*, which brought about this radical change and helped Electrical Engineering become the *front runner* in the Faculty in terms of total undergraduate student numbers.

Introduction of the Computer Engineering Minor, however, did more than merely increase undergraduate enrolment in Electrical Engineering. It kindled the academic staff's interest in computing and focussed attention on the use of computers and computing as a practical tool in teaching and research in Electrical Engineering. It helped to obtain and maintain *state-of-the-art* computing equipment and software, which, in turn, increased the level and quality of research. With modern computing facilities it was relatively easy to attract high quality academic staff,

graduate students, research associates and visitors from around the globe. It also helped the staff to bring in external research funding (see Fig. 5.6). In retrospect, the Minor served as a catalyst for the Department's explosive growth during the 1980's and gave it a new vitality and dynamism. Although no one knew it at the time, in starting this special programme, Electrical Engineering really *did hit the jackpot!*

The growth in undergraduate student numbers in Electrical/Computer Engineering (see Fig. 5.5) had a number of beneficial spin-offs. Firstly, since resource distribution is based largely on student contact hours, the increase in Electrical Engineering class sizes resulted in re-allocation of Engineering resources, both operational and capital budget funds as well as academic and support staff positions, in favour of the Department. Secondly, with the number of students seeking admission into the third year Electrical/Computer Engi-

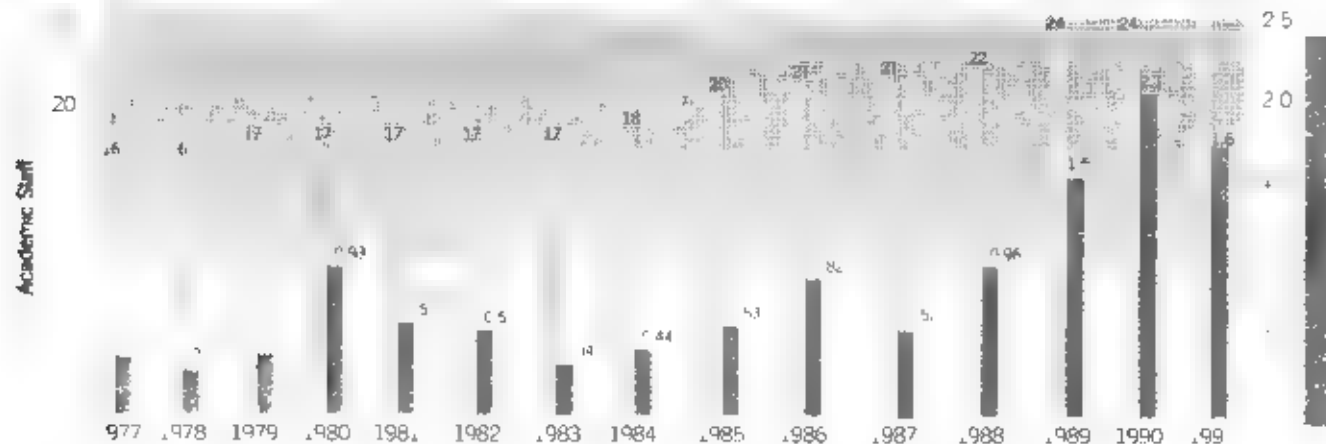


Fig. 5.6 Full-time Academic Staff and Annual External Research Funding in Electrical Engineering — 1977-1991

neering programmes run in the last 23 years their quota limits the Department was in the favourable position of being able to admit mainly top quality students producing average course performances above those attained in other departments. As a result, a high percentage of graduates from Electrical Computer Engineering were graduating *with distinction*. For example the first Computer Engineering Minor graduating class in the Spring of 1983 had 7 of 24 students graduating with distinction with one of them, Miss Leora Ariele Nestel, also winning the APEGGA Gold Medal. A number of these outstanding graduates continued their studies towards an MSc, MEng or PhD degree thereby helping to build and strengthen the graduate and re-



Dr. R. A. Stein



Dr. R. A. Stein



Dr. R. A. Stein



Dr. R. A. Stein

Dr. R. A. Stein, Dr. R. A. Stein, Dr. R. A. Stein, Dr. R. A. Stein, Dr. R. A. Stein

search programmes of the Department. During the second year of his term Len Bruton was taken with finding a replacement for J. M. Christ who resigned effective December 31, 1978. He was happy to accept the Departmental Committee's recommendation to appoint Dr. Laurence E. Turner, his own PhD student and a BSc and MSc graduate from the Department, effective November 1, 1979. A second appointment involved Professor Dimitris Zissos from the Department of Computer Science who had indicated an interest in becoming formally associated with Electrical Engineering in February 1977. After negotiations with Computer Science strong support from the departmental council and endorsement by

1981 Dr. R. A. Stein became acting Head for the period August 1 to November 30, 1981 at which time Dr. Gordon S. Hope was appointed the third Head of the Department until June 30, 1986.

The new academic position associated with the Minor in Computer Engineering was filled by appointing Dr. M. R. Smith effective September 1, 1981, the first Computer Engineering appointee in the Department.

After the announcement of Len Bruton's appointment as Dean at the University of Victoria effective July 1, 1983, Gordon Hope proceeded to find replacements for both Drs. Kendal and Bruton. He appointed Dr. K. V. S. Kaler to the biomedical engineering group and Dr. David Irvine-Haliday to the communications group, effective December 1, 1982 and February 1, 1983, respectively. Due to reallocation of staff positions within Engineering, Gordon Hope had the pleasant task of appointing three additional young staff members, namely Drs. R. M. Kangayyan, in biomedical engineering, B. Nowrouzian, in signal processing and image enhancement and M. T. Faltourne in communications, effective June 1, 1984 to June 1, 1985.



A person working at a computer terminal with a monitor and keyboard.

search programme of the Department.

A second important event during Len Bruton's Headship was the approval and funding by Alberta Government Telephones (AGT) of a Professorship in Telecommunications in Electrical Engineering at The U of C. With the creation of this Professorship in 1981-82 and the appointment of a staff member from the Department, Dr. S. T. Nichols as the inaugural holder of the AGT Professorship, which triggered the development of telecommunications as a separate and growing area of graduate study and research in the Department.

Although much if not most of his avocational time was spent in spear-

heading the Computer Engineering Minor, there were other tasks to be carried out by the Head. Already during the second year of his term Len Bruton was taken with finding a replacement for J. M. Christ who resigned effective December 31, 1978. He was happy to accept the Departmental Committee's recommendation to appoint Dr. Laurence E. Turner, his own PhD student and a BSc and MSc graduate from the Department, effective November 1, 1979. A second appointment involved Professor Dimitris Zissos from the Department of Computer Science who had indicated an interest in becoming formally associated with Electrical Engineering in February 1977. After negotiations with Computer Science strong support from the departmental council and endorsement by

John Kendal resigned to go into industry effective July 1, 1981, a resignation which Dr. Bruton was not able to act upon since due to family circumstances he was forced to resign his Headship effective July 31,



A person working at a computer terminal with a monitor and keyboard.

- Establishment of formal affiliations with industrial and governmental

Although graduate student enrollment declined after the mid 1970's and stayed relatively constant during the period 1980-1987, thereafter graduate student numbers increased steadily, almost doubling by the year 2000. The percentage of female students increased from 35% to 48% by 2000. Enrollment increased by an order of magnitude from approx-



research organizations including the Canadian Microelectronics Corp. (CMC), AMC and ATRC (now TRL). These affiliations brought about a degree of collaboration and interaction in graduate teaching and research, which would not have been possible without such formal ties. For example, starting in 1987, two graduate courses have been offered annually with the assistance of AMC. The Centre provided bipolar IC semi-custom designs to the students, fabricated their IC designs and returned them for testing near the end of the course. These affiliations also provided access to AMC's silicon foundry and fabrication and testing facilities in Edmonton and Calgary, respectively, and to Northern Telecom's Foundry in Ottawa through CMC.

- Initiation of joint research and development projects with industry and governmental research organizations which led to research funding like PRA, Project Related Assistance to Industry, and PAIT (Program for the Advancement of Industrial Technology) grants, equipment grants and loans from industry and other financial arrangements, including support for graduate students and research support personnel. As an example, we note the relationships the Communications Group established with TRL, AGT and Novatec which provided financial support for graduate students. A case in point was that of a PhD student

Mr. Ken Scott for whom special arrangements were negotiated to enable him to continue his employment with Novatec while carrying out his PhD research on TRL premises in Calgary.

A taste of the phenomena expansion of research activities in the Department is provided by a brief review of a few of the many outstanding and successful Electrical Engineering projects including:

- Dr. I. Bruton's work on digital filters and its initial application to seismic signal processing through a contract with Seis & Associates Ltd. led to a major study (1979-80) supported by Gulf Science and Technology, Pittsburgh, Pa. through a \$111,000 grant. The work used a general design procedure for computer enhancement of signals and images developed by Drs. Bruton and P.A. Ramamoorthy. Gulf Canada Resources in Calgary provided technical liaison between their Pittsburgh office and the research group, which also included Dr. R.A. Stein and Mr. N.R. Bartley.
- Drs. F.N. Trofimenko and I.W. Haslett continued their research on the electronic instrumentation

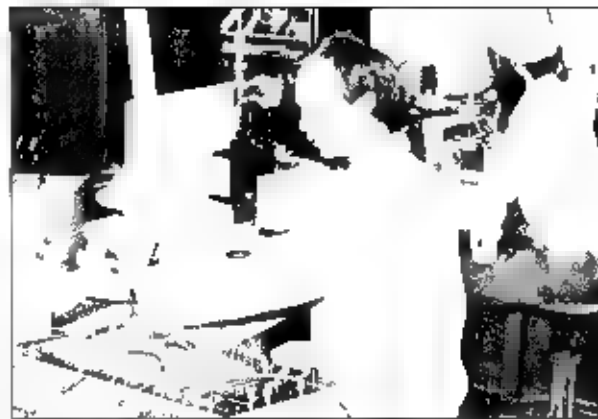


Figure 1: Dr. Bruton and his staff working on digital filters. The work was supported by Gulf Science and Technology, Pittsburgh, Pa. through a \$111,000 grant.

on oil and gas reservoir data (see Plate 5.36) and to Wodex Technology Inc. in Toronto for use in power meter applications.

Related to the digital electronic instrumentation system was a further study undertaken by Drs. Trofimenko and Haslett on the high temperature behaviour of semiconductor devices up to 200°C. Funded by a 3 year \$198,000 NSERC Strategic Grant (Oct. 1985 - Oct. 1988).

- Building on the contacts from their 1976 first USSR trip, Drs. O.P. Malik and G.S. Hope visited the Siberian Energy Institute in Irkutsk in 1979. They took a 1st version of their micro-processor based self-tuning adaptive power system stabilizer with them and tested it. An improved 2nd version of the stabilizer was designed and produced in Calgary and taken to Irkutsk in the Summer of 1984 for extensive field tests (see Plate 5.37). After evaluation of those tests and with interest in the research shown by TransAlta Utilities Corp. (formerly Calgary Power Ltd.) the two researchers obtained an NSERC Strategic grant, \$112,000 for the period 1986-89 for further improvement of their design. A new final prototype of the stabilizer was successfully tested on Oct. 18, 1989 on a 400 Mw generating unit at TransAlta's Keep Hope Power Station in Central Alberta.
- The Malik-Hope China Connection started with Dr. Malik's PhD student Mr. Shao-Cheng (1983-86) who after completion of his



Plate 2: Mr. Shao-Cheng, a PhD student, working on the adaptive power system stabilizer. The work was supported by the NSERC Strategic Grant. The equipment shown is a micro-processor based self-tuning adaptive power system stabilizer. The work was supported by the NSERC Strategic Grant. The equipment shown is a micro-processor based self-tuning adaptive power system stabilizer.

system initiated under the PAIT grant with Lynes Limited Services ending 1975-77 (see Plate 5.26). They improved the system, invented a voltage to frequency converter which they patented and then licensed the technology to two Canadian companies, M. Alster Perle in Services Ltd. in Calgary to develop home to surface transmissions of

PhD studies returned to his home institution, Huazhong University, Wuhan. Drs. Malik and Hope visited China in August 1986 (see Plate 5.38). Since then, a number of visiting Chinese scholars and graduate students have come to Calgary to collaborate with our Power Systems Group. One cooperative project involves the design of a microprocessor-based digital speed governor for hydro-power turbines. Mr. Zhao, L. (a visiting PhD student with Dr. Malik as supervisor) spent approximately a year in the Department building and testing a speed governor before he returned to Wuhan in January 1990 with the instrument. Drs. Malik and Hope and Mr. G.C. Hancock visited China in May-June of 1990 when they carried out successful tests with a product on prototype of the digital speed governor at the Ouyangha Hydro Power Station, Hunan Province, China. May 28-30. Collaboration continues with Dr. Malik's next visit to Wuhan having occurred in April 1991. The two researchers are also developing an Integrated Energy Management System (EMS), work which was supported by Hewlett-Packard Canada Ltd. through a \$75,000 equipment donation to G.S. Hope in 1989.

- Dr. David Irvine-Haidays research in fibre optics resulted in his



Plate 5.17: Drs. D.P. Malik and G.S. Hope with Mr. G.C. Hancock testing an improved digital speed governor. The microprocessor-based digital speed governor is a multi-stage digital speed governor. It is the first digital speed governor developed by the Chinese Academy of Sciences. During their visit to Calgary in July, 1989, they conducted extensive tests of the digital speed governor with digital speed governor developed by Soviet colleagues. Photo by Soviet colleagues.

STARMAP system which was awarded a US patent in March 1991. It is a multiple access protocol (MAP) for computer communication between systems of star shaped networks. In his work, David Irvine-Haidays is cooperating with researchers at Victoria University of Technology in Melbourne, Australia. Also, CANSTAR, a company in North York, Ont., is trying to incorporate STARMAP into the ANSI X3T9.3 FIBRE CHANNEL standard (see Plate 5.39).

- Dr. R.H. (Ron) Johnston has used electromagnetic (EM) signal analysis to determine water content in oil pipelines and in substrata work which was funded by a contract with SUNCOR Inc. (\$34,000, 1981-83) and involved measurements at their Bonnyville heavy oil field. The Petroleum Recovery Institute (PRI) also showed interest in this work for determining moisture content in sandstone cores.

More recently, he has been collaborating with TRI on the design of *diversity antennae* to overcome problems due to *multipath fading* in cellular phone communication. He and his students are also studying *radio wave propagation* (see Plate 5.40).

- The first computer engineering appointment: Dr. M.F. Smith is active in signal and image processing. In 1988, with Drs. Bruton, Nichols and Stein as co-applicants, he obtained a \$71,323 NSERC Equipment Grant for the purchase of a high speed image processing workstation. He is particularly interested in magnetic resonance imaging (MRI).



Plate 5.16: H.F. Sparrowood, L.F.N. Trifunakoff, Chaidou W. Huseff examining line flow rate electronic pressure and temperature recording device. Photo by Mr. Alexander Petrovich, Services, Calgary, Nov. 1990.

using modeling techniques as an alternative reconstruction approach, work in which he is collaborating with Dr. S.T. Nichols and a member of the Foothills Hospital MRI unit, Dr. A. Crawley.

Mike Smith and his co-workers developed a *Wheelchair Control Evaluation and Simulation* software package for preliminary training of patients in the use of power wheelchairs. This work was supported by equipment donations from IBM and Commodore Business Machines. Substantial equipment donations have also been received by Dr. Smith from Advanced Micro Devices (AMD) and Motorola Inc. for developing undergraduate laboratory facilities in the signal processing and microprocessor areas.

- In 1988, Dr. L.E. Turner with Drs. Nichols, Nowrouzian and Smith as co-applicants, was successful in obtaining a 3 year \$225,700 NSERC Strategic Grant for the development of a CAD tool for the efficient implementation of digital processing systems. After successful completion of the project, Novatel was using designs which were generated by the tool developed.
- The MICRONET Node at The U of C, which has been highlighted earlier and which involves Drs. L.T. Bruton (as principal investigator), B. Nowrouzian and L.E. Turner is part of a Canada-wide network of research groups

whose work is aimed at the development of systems involving ultra large scale integration. JLS Annual funding for the local Node is \$172 000 over a 5 year period.

- Dr R M Rangayyan is active in a number of biomedical engineering areas, including biomedical signal and image processing and enhancement. With Dr Leo Desautels of the Radiology Department, Faculty of Medicine, as co-applicant, they were awarded a 3 year NSERC Strategic Grant 1989-92 of \$76 000 per annum to develop image processing techniques for enhancement and analysis of mammograms to help in the diagnosis of early breast cancer. To support this work and with Drs Bruton Smith and Stein as co-applicants, he was also successful in obtaining a \$78 856 NSERC Equipment Grant (in 1989) for high resolution image digitization and display equipment. In another project, supported by the Arthritis Society of Canada and the Nickle Family Foundation, Dr Rangayyan and his co-researchers are using knee joint sound/vibration signal analysis for the diagnosis of cartilage pathology (see Plate 5.41).
- Dr K V S Kaer and his researchers have developed an automated cell levitation scheme to facilitate the study of single intact cells and tissue samples (see Plates 5.3 and 5.34). He is involved in research with the Communications Research Centre in Ontario to develop a gallium arsenide sensor for detecting high

frequency EM emissions from cells. He collaborates with colleagues in the US and in Germany and has spent a year at the University of Rochester in New York.

In cooperation with staff in the Faculty of Medicine, Dr Kaer is studying the use of electrical fields to facilitate healing of damaged mammalian ligaments. This work was funded by a \$140 000 grant (1988-91) from Medtronic Canada Ltd., matched by the Alberta Government through the Ministry of Technology, Research and Telecommunications, TRT.

- The VLSI Group has been most successful in attracting major outside funding and equipment grants and loans. There is now an excellent and complete design and test facility for analog, digital and mixed VLSI circuits. Much of the equipment was obtained through equipment loans and donations from the Canadian Microelectronics Corporation (CMC), some of which is used, owned jointly with Computer Science. In 1983-84, CMC loaned a complete VLSI test facility to The U of C for use by Electrical Engineering and Computer Science. Further equipment loans during 1986-87 in the amount of \$120 000 increased the value of the test facility to over \$300 000. During 1988, the Group and Computer Science obtained equipment valued at \$138 000 as well as \$200 000 worth of software loans from

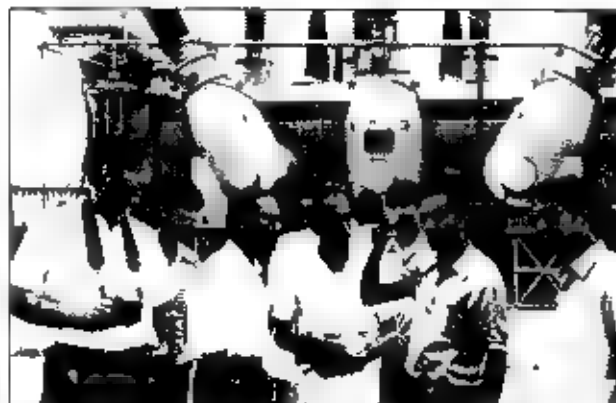


Plate 5.39: Drs. Malik (gesticulating) and G.S. Hope with Dr. Shoujie Cheng (L) of Huazhong University of Science and Technology, China, Professor Li Shihai and Mr Yuan Shi Fan. Superintendents of the Gezhouba hydroelectric power plant on the Yangtze River, the site of the new dam, invited the participants with a view to the dam's plant personnel. During their trip to China, Aug. 1-24, 1986, they also visited a number of other locations. Dr. Malik and G.S. Hope gave invited lectures at Huazhong University where they were given the opportunity to discuss some of their research. The visit to China was designed to extend their own research with three research groups in electrical engineering. It was with Huazhong University came about the visit. Dr. Cheng was Dr. Malik's PhD student at Calgary (1981-86).

CMC. In 1989, Jim Haslett in a joint application with Computer Science was successful in having CMC donate a sophisticated commercial IC testing system, valued at \$170,000, to the two departments. An equipment grant from CMC (\$131 400) and an NSERC Equipment grant (\$134,820) allowed the Department in 1990 to establish a new VLSI Laboratory (see Plate 2.12). The applications for these latter two grants were spearheaded by Jim Haslett, with Drs. Eldin, Gu Nowrouzian, Trofimenko and Turner as co-applicants.

- Dr Jun Gu was particularly successful in finding support for his research projects. During his first year at Calgary, he obtained external funding of \$416,295 for the period 1989-92 from the National Science Foundation (NSF) from NSERC (an operating grant and a 3 year Strategic Grant of \$68,280 per annum), from IEEE/ACM (Assoc. of Computing Machinery), a design automation award and from AMC.
- Drs. Haslett and Trofimenko developed a solid state high resolution optical position sensor which has been distributed to researchers at Canadian universities and has been used in sensing extremely minute changes in

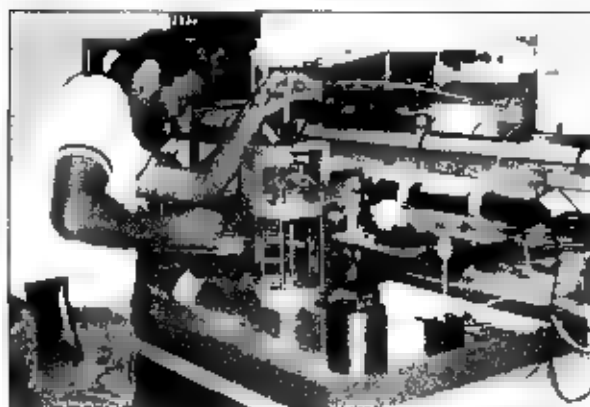


Plate 5.40: Dr. Jun Gu, in his laboratory, is working at a thermopile sensor for fibre optic networks (ca. 1984-85).

position (20 nm) and in studying the random motion of stars.

- Dr. B. Nowrouzian works on novel lossless discrete-integrator, LDI digital and switched-capacitor filters. In cooperation with L.T. Bruton he designed a high-performance LDI digital Jaumann filter and successfully implemented it on a DSP32 Development System donated by AT&T.
- Members of the Communications Group including Drs. Fattouche, Nichols and Sesay are involved in joint research projects with TRW, AGT and Novate. Student and research support from these organizations exceeds \$200,000 per annum.

In addition to research and teaching, the staff is also involved in professional, consultative, and development activities. For example, after a 2-week visit to the University of Cairo's Department of Electrical Engineering in 1988, Dr. O.P. Malik agreed to help develop a programme in digital control, digital protection and power electronics. He prepared and submitted a proposal to the Canadian International Development Agency (CIDA) requesting \$307,878 for development of programmes and laboratories in the specified three areas, including the training of personnel. The University of Cairo and The U of C are providing

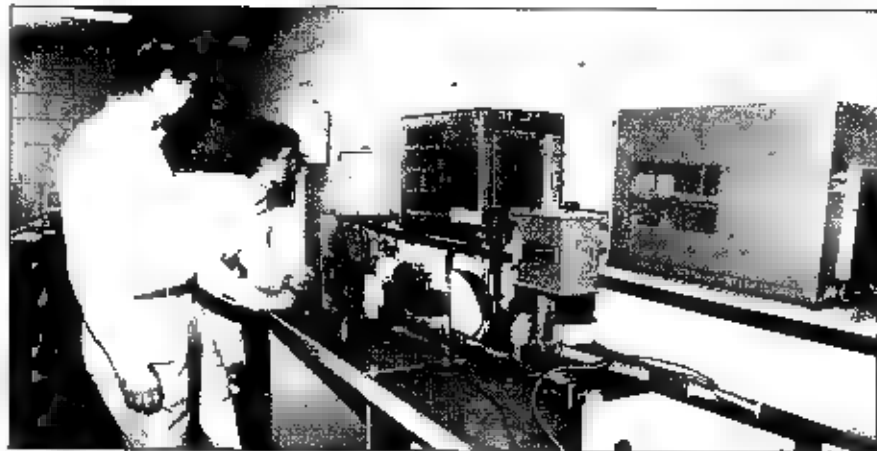


Plate 5.40 Dr. R.H. Johnston (L) with Mr. W.S. Fiaman in the Microwave Laboratory discussing the adjustment of a dual mode cavity resonator filter (ca. 1988-89)

\$328,500 and \$45,975, respectively. CIDA approved the proposal and is funding the project in the amount requested over a 5-year period, 1989-94. A number of staff and students from Cairo University have been in the Department during 1991. Dr. T.H. Barton is involved in the programme and is responsible for the power electronics area.

Another CIDA-funded undertaking is the so-called Nepal Engineering Education Project (see THE SILVER ANNIVERSARY Section of CHAPTER 1) was aimed at establishing new engineering and architectural BSc programmes at Tribhuvan University in Katmandu, Nepal. After his retire-

ment in 1988, Prof. Gunnar J. Berg became Manager of this 8-year \$5.0 million Project. He was recognized by APEGGA for his outstanding contributions to the profession and to society by being named recipient of the 1991 APEGGA Special Award, presented at the Association's First Summit Awards Gala at the Calgary Convention Centre, April 11, 1991.

In November 1991, the Board of Directors of IEEE named Dr. T.H. Barton the recipient of the prestigious Nikola Tesla Award for 1991 for his contributions to 'the practical application of the generalized theory of electrical machines to A.C. and D.C. drives' presented at the Power Engineering Society's winter Annual Meeting in New York, Jan. 28, 1992. At the same time he was also awarded the Yugoslav Union of Nikola Tesla Societies' Nikola Tesla Gold Medal and the Yugoslav Electric Power Industry's Plaque and Gold Coin featuring the image of Nikola Tesla.

An award highlighted earlier (see Plate 2.11) is the Ernest C. Manning Principala Award to Dr. L.T. Bruton in September 1991 for his outstanding work with the filtering of electronic signals in real time, using microelectronic technologies.

Further details of highlights and outstanding achievements by staff and students, as well as the present administrative structure and staff of the Department, its administrative history and the names of a full-time permanent academic and support staff with a service period of more than a year are indicated in Tables 5.1-5.4 at the end of Chapter 5.

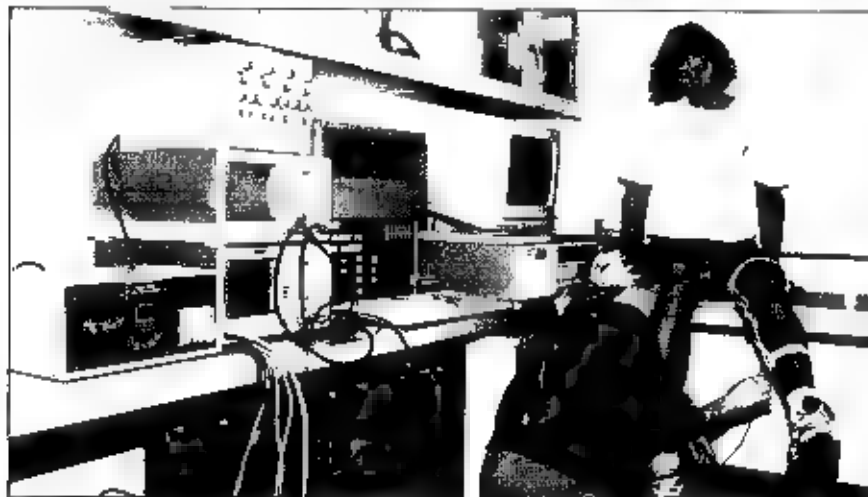


Plate 5.41 Dr. R.M. Rangayyan is involved in an interdisciplinary Biomedical Engineering research project dealing with knee joint sound/vibration signal analysis for the diagnosis of arthralgia/pain. He is collaborating with Drs. C. Frank and D. Bell in the Dept. of Surgery, Faculty of Medicine, and the Sport Medicine Centre, Faculty of Physical Education, respectively. The project is funded by the Arthritis Society of Canada, \$90,000 for the period 1990-92, and by the McKie Family Foundation equipment grant. The photograph shows Ms. Katherine Lally, MSc student in Medical Science attaching a goniometer and miniature accelerometers to the knee joint area of a volunteer to record knee joint angle and vibration signals (the latter produced by knee joint sounds). Sport Medicine Centre, 1990-91.

THE UNIVERSITY OF CALGARY

ELECTRICAL ENGINEERING GRADUATES

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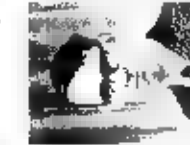
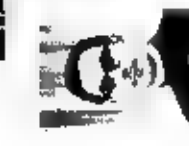


Plate 5.42 — The first Electrical Engineering graduating class - May 1969

Table 5.1 STAFF AND ADMINISTRATION — 1990-91
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

| | | |
|---|---|---|
| HEAD: Dr Haslett J.W
Administrative Assistant: Ms Rundle Angela | ACADEMIC STAFF
Dr Barton, T.H
Prof. Berg, G. (Emer.)
Dr Bruton L.T
Dr Chan W.C
Dr Eldin, A.
Dr Fattouche M
Dr Gu, Jun
Dr Hamza, M.H.
Dr Haslett J.W
Dr Hope, G.S
Dr Irvine-Halliday D
Dr Johnston R.H
Dr Kaei K.V.S | Dr Lagu, S
Dr Malik, O.P
Dr. Nichols, S.T
Dr Nowrouzian, B
Dr Rangayyan, R.M
Dr Rao, N.D
Dr Sesay, Abu
Dr Smith, M.R
Dr Stein R.A
Dr Streets R.B
Dr Trofimenkoff F.N
Dr Turner L.E |
| ASSOCIATE HEAD: Dr Stein R.A
Graduate Studies, | | |
| ASSOCIATE HEAD: Dr Rangayyan R.M
(Undergraduate Studies) | | |
| SECRETARIAL STAFF
Ms. Fraser Jennifer
Miss Lok Ella
Miss Pattison, Traci
Mrs Peshke, Linda
Mrs. Reimer Rachel (N/91 06 27)
Miss Reinelt, Valerie | | |
| TECHNICAL STAFF
Supervisor Mr Nordquist, Art
Mr Evanik, Ed
Mr Fiaman, Warren
Mr Hancock, Garwin
Mr Harrington, Garry
Mr Leikem, Steven
Mr Scharf, Glen
Mr Thomson, Robert
Mr Waish, Patrick | RESEARCH ASSOCIATES, ASSISTANTS AND PDF's
Mr Bartley Norm
Mr Beingsner Ed
Mr Chen Ganping
Mr Graumann, Peter
Dr Hassan M.A.M
Mr Ho, Tsu-Feng
Mr Huang, Xiaofei
Mr Lazar Michael
Mr L. Heping
Dr Liu Zhi-Qiang
Mr Nordquist, Scott
Dr Paranjape, Raman
Mr Svirhura, Michael
Mr Tarabochia, Jay
Dr Zhang, Yuanling
Dr Zhou, Erzhuang | |

Table 5.2 TIME LINE OF ADMINISTRATION - 1966-1992
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

| Year | Head | Departmental Secretary | Associate Head(s) | Technical Supervisor |
|------|--|-------------------------|---|---------------------------|
| 1966 | | Ethel French
(06.03) | | — |
| 1967 | F.N. Trofimenkoff
Acting
(04.01) | E.R. Fox
(03.01) | | A.E. Nordquist
(11.01) |
| | F.N. Trofimenkoff
(10.01) | E.R. Fox | | A.E. Nordquist |
| 1971 | R.A. Stein
Acting
(07.15) | E.R. Fox | — | A.E. Nordquist |
| 1972 | F.N. Trofimenkoff
(07.15) | E.R. Fox | — | A.E. Nordquist |
| 1976 | F.N. Trofimenkoff | F. Knight
(04.25) | | A.E. Nordquist |
| 1977 | L.T. Bruton
(07.01) | F. Knight | — | A.E. Nordquist |
| 1981 | R.A. Stein
Acting
(08.01) | F. Knight | | A.E. Nordquist |
| | G.S. Hope
(12.01) | F. Knight | | A.E. Nordquist |
| 1986 | J.W. Haslett
(07.01) | F. Knight | — | A.E. Nordquist |
| 1990 | J.W. Haslett | A. Rundle
(02.01) | R.M. Rangayyan
Undergraduate Studies
(07.01)
R.A. Stein
Graduate Studies
(07.01) | A.E. Nordquist |
| 1991 | R.M. Rangayyan
Acting
(07.01) | A. Rundle | R.M. Rangayyan
R.A. Stein | A.E. Nordquist |
| 1992 | J.W. Haslett
(07.01) | A. Rundle | R.M. Rangayyan
R.A. Stein | A.E. Nordquist |

Table 5.3 STUDENT AND STAFF AWARDS, PRIZES AND ACHIEVEMENTS

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING, 1966-91

I. Undergraduate Scholarsh p, Medal and Prize Winners

(a) Association of Professional Engineers, Geologists and Geophysicists of Alberta Gold Medal

| | | | | | |
|------------------------|-------------------|-------------------------|----------------------|-----------------------|---------------------|
| 1969 Huber D.W. | 1973 Kiddie, E.R. | 1977 Cassidy, B.J. | 1981 Yeung, P.S.F. | 1985 Brathwaite, R.N. | 1989 McGibney G.H. |
| 1970 Fitzpatrick, G.J. | 1974 Turner, J.E. | 1978 Zwierchowski, S.J. | 1982 Chrusch, C.M.E. | 1986 Lee, M.R. | 1990 Frey, B.J. |
| 1971 Vanderlaag, J.H. | 1975 Der, C.Y.C. | 1979 Cheung, S.S.R. | 1983 Neufeld, L.A. | 1987 van de Panne, M. | 1991 Kulach, C.J. |
| 1972 Wight, J.S. | 1976 Pascal, P.P. | 1980 McKibbin, J.K. | 1984 Davidson, G.W. | 1988 Poon, W.T.P. | 1992 Barker, I.W.S. |
| | | | | | 1993 Chung, Ch-L |

(b) Alberta Heritage (Louise McKinney) Scholarship

| | | | | | |
|----------------------|--------------------------|----------------------|-------------------|-----------------------|--------------------|
| 1981 Bodell, K.G. 2x | 1982 Long, J.R. 2x | 1986 Hankel, H.D. | 1987 Savard, M.M. | 1989 Korchinski, E.L. | 1991 Antony, M.P. |
| Chrusch, C.M.E. | 1983 Brathwaite, R.N. 2x | Lee, C.H.A. | Bleke, L.G. | Muszynski, B. | Cheng, H.L.M. |
| Davidson, G.W. 3x | Buckland, K.M. 2x | McGibney G.H. 3x | Dirk, M.J. | Diger, A.E. | Choy, L.T.E. 3x |
| Klassen, R.H. | Foxlow, T.J. | Tom, F.C.K. | McConachie, K.D. | Dumont, L.R. 2x | Ng, C.H.E. |
| Neufeld, L.A. | Skye, D.J. 3x | Worthington, S.D. 2x | Tom, F.C.K. | Lin, D.H. | Olecko, G.S. |
| Scott, K.E. | Svihura, M.J. 4x | Chau, T.T. | Bartel, M.H. | Oliver, P.D. 2x | Sokolosky, J.C. |
| Colpitts, D.J. | van de Panne, M. 3x | Farebrother, M.D. | Beingessner, E.C. | Shoham, I. | Taylor, D.C. |
| Dale, G.W. 3x | Concina, S. | Frey, B.J. 3x | Cole, K.B. 3x | Tu, D.H. | 1993 Cheng, H.L.M. |
| Graham, D.A. 2x | Erfanian, J.A. | Klukas, R.W. 2x | Donne, J.D. 3x | Wekai, T.S. | Chu, W.C.A. |
| Hiller, R.G. | Grundmann, L.R. 2x | Lecerf, S.D. 2x | Driediger, T.N. | Wilms, B.D. 2x | |

(c) Canadian Western Natural Gas Co. (The Gas Co.) Undergraduate Scholarship in Engineering

| | | | | | |
|-------------------|---------------------|---------------------|----------------------------|--------------------|------------------------|
| 1967 Agnew, D.G. | 1974 Kovatch, R.P. | 1978 McKibbin, J.K. | 1982 Wong, R.K. | 1985 Spinney, A.W. | 1988 McCallinden, D.P. |
| Huber, D.W. | 1975 Best, W.B. | Williams, M.J. | 1983 von Schoening, K.O.E. | 1986 Rahim, S.B. | 1990 Lam, C.L. |
| 1970 Thirsk, R.W. | Pascal, P.P. | Hewitt, L.B. | 1984 Lau, K.H.H. | 1987 Bharadwa, N. | 1991 Milenko, P.F. |
| 1971 Kiddie, E.R. | 1977 Tong, C.K. | 1981 Boyd, J.E. | Ng, P.F.R. | Bleke, L.G. | Smith, M.J. |
| 1973 Der, C.Y.C. | 1978 McKenzie, M.J. | Colpitts, D.J. | 1985 Fung, K.L.Y. | 1988 Baudais, M.R. | 1992 Chan, T.H. |

(d) The Transalta Utilities (Calgary Power) Memorial Scholarship

| | | | | | |
|-----------------------|------------------|----------------------|-------------------|-------------------|------------------|
| 1976 Washington, G.R. | 1979 Freed, R.E. | 1981 Meredith, G.O. | 1984 Lau, M.H.C. | 1987 Bashai, C.N. | 1989 Smit, D. |
| Petersen, G.H. | Hewitt, L.B. | 1982 Buckland, K.M. | Loh, F. | Baudais, M.R. | 1990 Huber, G.J. |
| Smarek, P.L.R. | Neufeld, L.A. | Saar, W.M. | Chau, T.T. | Patton, E.J. | Knudtson, D.P. |
| 1977 Blackman, J.M. | Scott, K.E. | Stewart, S.Y. | Platt, R.S. | Diger, A.E. | Yue, W.M.T. |
| 1978 Gwozd, J.E. | Bullen, D.S. | 1983 Choudhury, A.A. | 1986 Klukas, R.W. | Driediger, T.N. | 1991 Brown, G.T. |
| 1979 Chrusch, C.M.E. | McLung, C. | Ginter, T.S. | Mawji, M.H.J. | Lin, D.H. | Halderson, B.T. |

(e) APEA/APEGGA (A Clayton Milroy) Scholarship

| | |
|------------------------|-----------------------|
| 1966 Agnew, D.G. | 1977 McKibbin, J.K. |
| 1968 Jamniczky, L.A.F. | 1982 Brathwaite, R.N. |
| 1972 Der, C.Y.C. | 1983 Lau, K.H.H. |
| 1974 Paquet, J.L. | 1984 Spinney, A.W. |

| | |
|--------------------|---------------------|
| 1985 Abraham, A.R. | 1986 Savard, M.M. |
| 1987 Chia, K.G. | 1988 Williams, B.D. |
| 1989 Wilms, B.D. | 1990 Gall, W.E. |

(f) Home Oil Co. Ltd. Centennial Scholarship

| | | |
|-------------------------|----------------------|---------------------|
| 1968 Vaughan-Pope, D.A. | 1987 Elsaesser, D.S. | 1989 Shoham, I. |
| 1979 Koskovich, G.N. 3x | 1988 Hankel, H.D. | 1990 Parks, R.G.J. |
| 1985 Gurtler, P.J. | 1989 Savard, M.M. | 1991 Knudtson, D.P. |
| 1986 Abraham, A.R. 2x | 1989 Lee, M.Y. | Taylor, D.C. |
| | | |

(g) Robert B. Paugh Memorial Bursary

| | |
|----------------------------|--------------------|
| 1969 Kiddie, E.R. | 1983 Webb, D.K. |
| 1973 Turner, J.E. | 1984 Ang, E.D. |
| 1974 Best, W.B. | Nguyen, Q.T. |
| 1977 Gunderson, R.G. | 1985 Bond, G.W. |
| 1979 Staples, H.K. | 1987 Louie, S.S.Y. |
| 1981 Hagerman, D.D. | 1989 Esau, L.D. |
| 1982 von Schoening, K.O.E. | 1991 Ng, Y.M. |

(h) The Tony Neidermayer Memorial Bursary

| | | |
|-----------------|-------------------|----------------------|
| 1984 Swab, L.W. | 1988 Bharadwa, N. | 1990 Chow, K.S.K. |
| 1985 Lo, Y.H. | Patton, E.J. | Encon, G.H. |
| Stafford, C.D. | Arcega, V. | Smith, L.M. |
| Tom, F.C.K. | Dirk, M.J. | 1991 Chew, S.P. |
| 1987 Beck, D.S. | Tran, T.Q. | 1992 Nisar, M. |
| Gholaman, L.M. | Chak, C.P. | 1993 Calbourne, L.L. |
| Pham, J.P. | | |

(i) Can. Gas Processors Association Silver Anniversary*/M. Frith Memorial Scholarship or Book Prize

| | | | | | |
|-----------------------|-------------------------|----------------------|---------------------|----------------------|--------------------|
| 1967 Prater, W.E. | 1974 Der, C.Y.C. | 1980 Day, L.A. | 1984 Lafrenz, J.L.* | 1987 Lee, C.H.A.* | 1991 Parks, R.G.J. |
| 1968 Alexandre, E.E. | 1977 Zwierchowski, S.J. | 1981 Stichbury, R.G. | 1985 Lee, M.R.* | 1988 Grundmann, L.R. | 1992 Smith, M.J. |
| 1970 Vanderlaag, J.H. | 1978 Cheung, S.S.R. | 1982 Scott, K.E. | 1986 Shaw, J.L.* | 1989 Chia, K.G. | |

(j) Dome Petroleum Ltd. Scholarship or Bursary in Engineering

| | |
|------------------------|------------------|
| 1966 Huber, D.W.* | 1986 Li, S.H.H. |
| 1980 Davidson, G.G.W.* | 1987 Li, T.S.P. |
| 1981 McDonald, D.M. | Hengst, D.W. |
| 1985 Lam, F.L.Y. | 1988 Ahuja, K.K. |

(k) Schlumberger of Canada Ltd. Scholarship or Collegiate Award

| | |
|-----------------------|-------------------|
| 1970 Vanderlaag, J.H. | 1983 Bodell, K.G. |
| 1980 Chrusch, C.M.E. | 1984 Lee, L.S. 2x |
| 1982 Marrett, A.P. | Tsai, Y.W. |
| Neufeld, L.A. | 1986 Poon, W.T.P. |

(l) Trotter & Morton Ltd. W. Watson Bursary

| | |
|-------------------|----------------------|
| 1976 Hickie, D.J. | 1986 Nordquist, S.E. |
| 1984 Lee, J.W. | 1989 Bidin, B. |
| 1985 Fong, R. | 1991 Shaw, P.L. |
| Nguyen, H.N. | 1992 Antony, M.P. |

(m) W.G. (Bill) Howard Memorial Foundation Award

| | |
|-------------------------|---------------------|
| 1981 Campbell, K.J.M. | 1989 Gurtler, D.B. |
| 1985 Bond, G.W. | Lecerf, S.D. |
| 1986 Albrecht, C.R.J.E. | 1990 Geeraert, E.P. |
| 1988 Norris, D.W. | 1993 Bradshaw, J.E. |

(n) Shell Canada Resources Ltd. Scholarship

| | |
|--------------------|---------------------|
| 1975 Pascal, P.P. | 1984 Li, C.O. |
| 1981 Leckie, B.M. | 1985 Chan, G.K.H. |
| 1982 Klassen, R.H. | 1986 Kramer, H. |
| 1983 Marrett, A.P. | 1993 Knudtson, D.P. |

(o) Suncor Inc. Scholarship in Engineering

| | |
|--------------------|----------------------|
| 1981 Hewitt, L.B. | 1986 Shaw, J.L. |
| 1982 Scott, K.E. | 1989 Spinney, A.W. |
| 1984 Stewart, S.Y. | 1988 Bartel, M.H. |
| 1985 Shaw, J.L. | 1991 Kularatna, A.S. |

*x = n years

| (p) Cactus Drilling Corp. Ltd Bursary | | | | | (q) Funtron,x Amusements Ltd Award in E F | | | | | |
|---|-----------------------|---|-----------------------|------|---|------------------|--|------|------------------|------------------|
| 1967 | Coldham, D.B. | 1986 | Harlow, D.R. | 1990 | Ralston, W.A. | 1984 | Choudhury, A.A. | 1986 | Chau, T.T. | |
| 1979 | Neame, R.A. | 1987 | Glaser, E.P.H. | 1991 | Chamoun, F. | | Lee, M.R. | | Doerksen, R. J. | |
| 1982 | Costigan, P.R. | 1988 | Chan, H.Y. | 1992 | Chik, C.P. | 1985 | Lau, K.H.H. | 1987 | Hankel, H.D. | |
| | McDonald, D.M. | 1989 | Patton, E.J. | | Ratzlaff, S. | | Smith, R.L. | | Mah, A.G. | |
| | | | | | | | | | Chia, K.G. | |
| | | | | | | | | | Kish, B.J. | |
| | | | | | | | | | Lever, C.M. | |
| | | | | | | | | | Weker, T.S. | |
| (r) Bechtel Canada Ltd Bursary | | | | | (s) Amoco Can Petr Co Ltd Scholarship | | | | | |
| 1981 | Josephs, R.T. | 1985 | Evelyn, W.H. | 1987 | Arcega, V. | 1989 | Akitt, T.M. | 1981 | Llanos, E.M.G. | |
| 1983 | Cellars, B.E. | | Vollmerhaus, A. | 1988 | Ahuja, K.K. | | Lau, C.Y.K. | 1982 | Pluemeck, G.G. | |
| | Stafford, C.D. | 1986 | Bialla, L.G. | | Narayanan, R. | 1991 | Lam, S. | 1983 | Dehler, G.B. | |
| 1984 | Lo, Y.H. | | Radke, T.S. | | | | | | Derkitt, T.J. | |
| | | | | | | | | | 1990 | Muszynski, B. |
| | | | | | | | | | 1991 | Yue, W.M.T. |
| | | | | | | | | | 1992 | Shaw, R.L. |
| | | | | | | | | | 1993 | Gibb, S.G. |
| (t) Petroleum Society of CIM
Calg. Section Scholarship | | | | | (u) EIC Calgary Branch
Scholarship | | | | | |
| 1983 | Abraham, A.R. | 1991 | Nisar, M. | 1967 | Alexandre, E.E. | 1984 | Swab, L.W. | 1980 | Bonang, D.A. | |
| 1986 | Purohit, J.M. | 1992 | Halldorson, B.T. | 1974 | Staroszk, W.D. | 1985 | Beuerlein, B.E. | 1981 | Walters, J.L. | |
| | Radke, T.S. | | Kim, K.I. | 1975 | Cassidy, B.J. | 1987 | Radke, T.S. | 1982 | Derkitt, T.J. | |
| 1989 | Dinger, A.E. | | Knudson, D.P. | 1978 | Neame, R.A. | 1988 | Basher, C.N. | 1983 | Massey, D.R. | |
| | Jin, D.H. | 1993 | Bulman, J.E. | 1982 | McLung, C.J. | 1992 | Chau, T.H. | 1984 | Falkenberg, A.C. | |
| | McConachie, K.D. | | | 1983 | Stewart, S.Y. | | | | 1985 | Jones, D.G. |
| | | | | | | | | | 1986 | Poyhja, R.T. |
| | | | | | | | | | 1987 | Swaniewicz, E.G. |
| | | | | | | | | | 1989 | Osvath, C. |
| (v) Wilma E. Mitchell
Memorial Bursary | | | | | (x) Canada
Scholarship | | | | | |
| 1984 | von Schoening, K.O.E. | 1989 | Chow, K.S.K. | 1990 | Huber, G.J., 2x | 1992 | Cheng, H.C.M. | 1990 | Driediger, T.N. | |
| 1985 | Lee, J.W. | 1990 | Dang, H.Q. | | Kim, K., 3x | | Choy, L.T.E. | | Smit, Dick | |
| 1986 | Smith, R.L. | 1991 | Nguyen, D.P. | | Taylor, D.C., 3x | 1993 | Cheng, H.C.M. | 1991 | Kim, K.I. | |
| 1987 | Sopczak, L.M.T. | 1993 | Lam, J.T. | 1991 | Sokolosky, J.C., 2x | | Choy, L.T.E. | | Lee, C.S. | |
| | | | | | | | | | 1992 | Dang, D.N. |
| | | | | | | | | | 1993 | Gill, H. |
| | | | | | | | | | | Leung, W.K.L. |
| (z) Viscount Bennett
Scholarship | | | | | (a, T & F Nitescu
Scholarship | | | | | |
| 1982 | McLung, C.J. | 1987 | Kish, B.J. | 1988 | Korchinski, E.L. | 1992 | Chew, S.P. | 1981 | Walkey, D.J. | |
| 1985 | Harlow, D.R. | | Korchinski, E.L. | | Tong, M.S.M., 3x | | Chung, C.L. | 1982 | Chmilar, D.W. | |
| | Smith, A.H. | 1988 | Shoham, J. | 1991 | Barker, W.S. | | Kulrajana, A.S. | | Jorgensen, K. | |
| | Spinney, A.W. | | | | Cochrane, B. | 1993 | Siew, B.K. | | Llanos, E.M.G. | |
| | | | | | | | | 1983 | Otto, R.A. | |
| | | | | | | | | 1984 | Fowlow, T.J. | |
| | | | | | | | | 1986 | Gurtler, P.J. | |
| | | | | | | | | | Mah, A.G. | |
| (y) Hi-Fun Amusements Ltd
Scholarship | | | | | (b) A.W. Dingman
Memorial Scholarship | | | | | |
| 1980 | Yeung, P.S.F. | 1982 | von Schoening, K.O.E. | 1985 | Burke, J.A. | 1988 | Nguyen, H.V. | 1978 | Neame, R.A. | |
| 1981 | Hiller, R.G. | | Wood, D.A. | 1986 | Li, T.S.P. | 1989 | Jacobsen, C.R. | 1981 | Paslawski, D.J. | |
| | Staples, H.K. | 1983 | Hiadik, T.D. | 1987 | Chan, Y.S. | 1990 | Lee, C.S. | 1985 | Evelyn, W.H. | |
| 1982 | Meir, D.R. | | Wong, K.L.K. | | | | | | 1987 | Radke, T.S. |
| | | | | | | | | | 1988 | Le, M.V. |
| (c) Calgary Electronic
Club Bursary | | | | | (d) Goliad Resources
Ltd Bursary | | | | | |
| 1966 | Coldham, D.B. | Can. -Montana Gas Co. Ltd. Sch. in Eng. | | | 1984 | Long, J.R. | EIC Eng. Student of the Year Medal | | | |
| | Coldham, D.B. | Canadian Cities Service Petr. Corp. Scholarship | | | | Stafford, C.D. | W.H.B. Sharp Memorial Scholarship in Engineering | | | |
| | Gibson, A.J. | British American Paint Co. Bursary in Eng. | | | 1985 | Bauerlein, B.E. | Husky Oil Operations Ltd. Scholarship | | | |
| 1967 | Card, J.D. | Can. Montana Gas Co. Ltd. Sch. in Eng. | | | | Davies, R.J. | B.P. Canada Bursary | | | |
| | Coldham, D.B. | Canadian Cities Service Petr. Corp. Scholarship | | | | Dykema, H.J. | Avalon Travel Bursary | | | |
| 1968 | Huber, D.W. | R.J. Broderick Memorial Scholarship | | | | Fong, R. | G.R. & V.E. Mortimer Bursary | | | |
| | McClure, D. | British American Paint Co. Bursary in Eng. | | | | Lang, D.E. | Andex Oil Co. Ltd. Bursary | | | |
| 1972 | Kiddle, E.R. | Chester's Tool Supply Ltd. Bursary | | | | Oakley, C.L.M. | W.L. Hamilton Bursary | | | |
| | Lefebvre, J.M. | Francis F. Reeve Foundation Undergrad. Bursary | | | | Poon, W.T.P. | Underwood McLellan Ltd. Scholarship | | | |
| 1974 | Pascal, P.P. | Bapco Paint Co. Ltd. Bursary | | | | Swab, L.W. | Monenco Scholarship | | | |
| 1975 | Zwierchowski, S.J. | Sun Oil Co. Ltd. Scholarship | | | | Tutis, H.C. | Aberford Resources Ltd. Bursary | | | |
| 1976 | Zwierchowski, S.J. | J.B.M. Bursary | | | 1986 | Bauer, J.M. | Frank McCullough Undergrad. Bursary | | | |
| 1977 | Falkenstein, M.K. | Molson Companies Donation Fund. Alb. Sch. | | | | Coffman, J.A. | Canadian Occidental Petr. Ltd. Bursary | | | |
| | Kam, S.H.P. | Sun Oil Co. Ltd. Scholarship | | | | Glaser, E.P.H. | Stearns Catalytic Ltd. Scholarship | | | |
| | McKenzie, M.J. | Bapco Paint Co. Ltd. Bursary | | | | Lang, D.E. | Andex Oil Co. Ltd. Bursary | | | |
| | Neame, R.A. | Student's Union Bursary | | | | Shaw, K.C. | Aberford Resources Ltd. Bursary | | | |
| | Williams, M.J. | Bapco Paint Co. Ltd. Bursary | | | 1987 | Doerksen, R.J. | Husky Oil Operations Ltd. Scholarship | | | |
| 1978 | Cheung, S.S.R. | Sun Oil Co. Ltd. Scholarship | | | | Evelyn, W.H. | Aberford Resources Ltd. Bursary | | | |
| | Halbertsma, J.J.G. | Commonwealth Construction Co. Ltd. Bursary | | | | Gurtler, D.B. | Andex Oil Co. Ltd. Bursary | | | |
| 1979 | Clarke, D.J.P. | Canadian Cities Service Petr. Corp. Scholarship | | | | Lee, C.H.A. | Nova (An Alb. Corp.) Scholarship | | | |
| | Day, L.A. | Siebens Oil & Gas Ltd. Scholarship | | | | Mawji, M. | Francis F. Reeve Foundation Undergrad. Bursary | | | |
| | Garrett, P.C. | Dolphin Drilling Ltd. Scholarship | | | | Platt, R.S. | Monenco Scholarship | | | |
| 1980 | Colpitts, D.J. | Dolphin Drilling Ltd. Scholarship | | | | van de Panna, M. | Governor General's Medal | | | |
| | Klassen, R.H. | Dominion Oil Fields Supply Co. Ltd. Bursary | | | | van de Panna, M. | Munir Kovitz Prize | | | |
| | Shpak, D.J. | Jkranian (Calgary) Savings and Credit Union Award | | | 1988 | Arcega, V.I. | J. & A. Pearson Memorial Bursary | | | |
| 1981 | Braithwait, R.H. | Dolphin Drilling Ltd. Scholarship | | | | Basher, C.N. | G.R. & V.E. Mortimer Bursary | | | |
| | Day, L.A. | D.S. Stevens Scholarship | | | | Dang, H.Q. | W.L. Hamilton Bursary | | | |
| | Graham, D.A. | Underwood McLellan Ltd. Scholarship | | | | Griffith, M.B. | J. of C. Support Staff Undergrad. Bursary | | | |
| | Stichbury, R.G. | Canadian Cities Service Petr. Corp. Scholarship | | | | Kramer, H. | J. of C. Support Staff Undergrad. Bursary | | | |
| 1982 | Boyd, J.E. | Nova (An Alb. Corp.) Scholarship | | | | Swaniewicz, E.G. | The Federated Pipe Lines Ltd. Scholarship | | | |
| | Griffith, J.S. | McMahon Stadium Society City of Calgary Award | | | | Tran, T.Q. | Enron Oil Canada Ltd. Bursary | | | |
| | Massey, D. | McMahon Stadium Society City of Calgary Award | | | 1989 | Ahuja, K.K. | EIC Eng. Student of the Year Medal | | | |
| 1983 | Balston, B.G. | Monenco Scholarship | | | | Danishin, T. | Rogers Communications Inc. Scholarship | | | |
| | Li, C.O. | Gulf Canada Centennial Scholarship | | | | Durec, R.J. | W.H.B. Sharp Memorial Scholarship in Engineering | | | |
| | Paslawski, D.J. | W.H.B. Sharp Memorial Scholarship in Engineering | | | | Fritz, P.S. | Canadian Occidental Petr. Ltd. Bursary | | | |
| 1984 | Buckland, K.M. | Aberford Resources Ltd. Bursary | | | | Parker, R.A. | Enron Oil Canada Ltd. Bursary | | | |
| | Chan, M.W.K. | J. of C. Support Staff Undergrad. Bursary | | | | Purohit, L.M. | Champlin Canada Ltd. Scholarship | | | |
| | Cook, C.G. | Monenco Scholarship | | | | Zaman, S.U. | Alumni Assoc. of J. of C. Int. Students Bursary | | | |
| | Lafrenz, J.L. | Dolphin Drilling Ltd. Scholarship | | | | | | | | |

(x) Others (cont'd)

| | | | | | |
|------|---|--|------|--|--|
| 1990 | Barker, W.S.
Foltinek, D.S.
Frey, B.J.
Frey, B.J.
Lau, C.Y.K.
Levee, C.M.
Nguyen, T.H.
Tran, T.Q.
Tran, T.Q.
Vonkeman, A.L.
Zaman, S.J. | Rogers Communications Inc. Scholarship
EEE Hackbush Award & Prize
EEE Hackbush Award & Prize
EIC Eng. Student of the Year Medal
Ausquac Energy Ltd. Bursary
G.R. & V.E. Mortimer Bursary
J. & A. Pearson Memorial Bursary
Stewart Bursary
R.W. Zwicky Memorial Bursary
McMahon Stadium Society City of Calgary Award
Alumni Assoc. of J of C Int. Students Bursary
Union Pacific Resources Inc. Scholarship
G.R. & V.E. Mortimer Bursary
Enron Oil Canada Ltd. Bursary
Canadian Fed. of Univ. Women (Calg. North) Bursary
W.A. Walter Bursary
Husky Oil Operations Ltd. Scholarship
Governor General's Medal
Muriel Kowitz Prize
R.W. Zwicky Memorial Bursary
J. & A. Pearson Memorial Bursary
University Women's Club of Calgary Bursary
W.A. Walter Bursary
W.A. Walter Bursary | 1991 | Roy, G.
Smit, D.
Smith, D.R.
Sokolosky, J.C.
Stenseth, O.C.
Vonkeman, A.L.
Wittiger, K.D.V.
Zeng, X.J.
Brown, G.T.
Chamberlain, R.J.
Cheng, M.L.M.
Colbourne, L.L.
Gall, W.E.
Hua, M.N.
Kneller, G.R.
Monro, A.T.
Nguyen, D.D.
Norvita, T.J.
Lam, S.
Sokolosky, J.C.
Xu, K.
Zeng, X.J.
Sokolosky, J.C. | Stewart Bursary
Rogers Communications Inc. Scholarship
W.L. Hamilton Bursary
U. of C. Eng. Class of 70 Jim Low Memorial Sch.
Sadie M. Nelson Bursary in Electr. Eng.
McMahon Stadium Society City of Calgary Award
Delta Catalytic Corp. Bursary
University Women's Club of Calgary Bursary
of C. Eng. Class of 70 Jim Low Memorial Sch.
Canadian Occidental Petr. Ltd. Bursary
B.J. Seaman Scholarship
Hans M. Nielsen Memorial Undergrad. Bursary
Enron Oil Canada Ltd. Bursary
W.L. Hamilton Bursary
Delta Catalytic Corp. Bursary
Rogers Communications Inc. Scholarship
Stewart Bursary
W.H.B. Sharp Memorial Scholarship in Engineering
Sadie M. Nelson Bursary in Electrical Eng.
Canadian Hospital Eng. Soc. Henry Pun Mem. Sch.
Stewart Bursary
Fluor Daniel Canada Inc. Scholarship
EIC Eng. Student of the Year Medal |
| 1991 | Boudais, B.G.
Chamberlain, R.J.
Esau, L.D.
Fisher, A.J.
Gall, W.E.
Huber, G.J.
Kulach, C.J.
Kulach, C.J.
Lam, C.L.
Lau, C.Y.K.
Nguyen, T.H.
Olecko, G.S.
Patton, M. | | | | |

I Graduate Scholarship, Medal and Prize Winners

(a) NRC/NSERC Postgraduate Scholarship

| | | | | | | | | | | | |
|------|---------------------|------|------------------------|------|--------------------|------|-------------------|------|---------------------|------|------------------|
| 1966 | Haslett, J.W., 3x* | 1971 | McClure, D., 2x | 1982 | Walkey, D.J., 4x | 1986 | Hani, A.K., 2x | 1989 | McGibney, G., 2x | 1991 | Klukas, R.W., 2x |
| 1968 | Altenhof, T.G., 3x | 1972 | Rasmy, M.E.M. | 1983 | Boyd, J.E., 3x | | Ledee, B.M., 2x | | Morrow, W., 2x | | Kulach, C.J., 2x |
| | Pederson, R.T., 2x | | Owai, A.R. | | Colpitts, D.J., 2x | | McLeod, K. | 1990 | Douglas, M.G., 2x | | Morris, B.J., 2x |
| 1969 | Dennis, L.P., 3x | 1973 | Vaughan-Pope, D.A., 3x | 1984 | Bodell, K.G. | 1988 | Scott, K.E., 2x | | Finvers, I.G., 3x | | Patton, E. |
| | Jamnicki, J.A., 2x | 1974 | Aboukhef, M.M., 3x | | Dawson, G.W. | | Lee, C.H.A. | | Frey, B.J., * | | Pye, S.G., 2x |
| | Prater, W.E., 2x | 1975 | Turner, J.E., 2x | | Graham, D.A. | | Pennig, A., 2x | | Jazai, M.S., 3x | | Shoham, J., 2x |
| | Smallwood, R.E., 2x | 1977 | Benjamin, N.V., 2x | | Merritt, A.P. | | Sahara, M., 2x | | Lynch, T. | | Tom, F. |
| 1970 | Huber, D.W., 3x | 1980 | Angus, A.D., 2x | 1985 | Fowler, T.J., 3x | 1989 | Goud, P., 2x | | Worthington, S., 2x | | Wekel, T.S., 2x |
| | Runtz, K.J., 2x | | Sprecker, T.C., 3x | | Lafrenz, J.L., 2x | | Grundmann, L., 4x | 1991 | Beingsner, E.C., 2x | 1992 | Barker, W.S. |
| 1971 | Friedman, G.A. | 1982 | Hewitt, B.L., 2x | 1986 | Green, B.D. | | Jorgenson, M. | | Jin, D.H., 2x | | Dumont, L.R. |

* NSERC 1967 Science and Engineering Scholarship

(b) Alberta Government Telephones, AGT Centennial Scholarship/Fellowship

| | | | | | | | | | | | |
|------|---------------|------|----------------|------|------------------|------|----------------------|------|----------------|------|-------------------|
| 1972 | Coldham, D.B. | 1974 | Dorrah, H.T.H. | 1975 | Meklad, M.S., 2x | 1977 | Mansour, Y.M.Y. | 1980 | Shaw, G.R., 2x | 1991 | Benner, E.R. |
| | Scholz, F.J. | 1974 | Khadr, A.A.M. | 1977 | Turner, J.E., 3x | 1980 | Hiskewch, B.R.J., 2x | 1990 | Zhang, H. | | Grundmann, L., 2x |

(c) Alberta Microelectronics Centre Scholarship

| | | | | | | | | | | | |
|------|-------------------------|------|------------------|------|-------------------|------|---------------------|------|-------------------|------|--------------|
| 1987 | Gonnason, W.R., 2x | 1989 | Nagalla, R., 2x | 1989 | Yang, L., 2x | 1990 | Williamson, I., 2x | 1991 | Smith, L.M., 2x | 1992 | Klukas, R.W. |
| | Nordquist, S.E., 3x | | Qin, J., 2x | 1990 | Finvers, I.G., 3x | 1991 | Beingsner, E.C., 2x | | Wekel, T.S., 2x | | Puri, R. |
| 1989 | Balasubramanian, S., 2x | | Singaravelan, B. | | Sepa, M. | | Patton, E.J. | | Worthington, S.D. | | Yu, H. |

(d) Alberta Telecommunications Research Centre/Laboratories, TR Labs. Scholarship or Fellowship

| | | | | | | | | | | | |
|------|--------------------|------|-----------------|------|-------------------|------|--------------|------|---------------|------|----------------|
| 1989 | Deng, T., 2x | 1990 | Chia, K.G., 3x | 1991 | Schuler, J.G., 2x | 1992 | Dumont, L.R. | 1992 | Funk, G.D. | 1992 | Lau, C.Y.K. |
| | Gibson, A.F., 2x | | Douglas, M., 3x | | Thoi, D.M., 2x | | Ebes, B.A. | | Gibbard, M.R. | | Lee, C.S. |
| | Goud, P., 2x | 1991 | Olasz, E.B., 2x | 1992 | Benner, E.R. | | Fisher, A. | | Klukas, R.W. | | Levesque, L.J. |
| | Morrison, G.D., 4x | | | | | | | | | | |

(e) Province of Alberta Graduate Scholarship or Fellowship*

| | | | | | | | | | | | |
|------|----------------|------|-----------------|------|-----------------|------|-----------------|------|-----------------|------|-------------------|
| 1969 | Dutta, S.R.K. | 1983 | Koskovich, G.N. | 1991 | Bertschmann, R. | 1971 | Aly, G.E.M. | 1982 | Owan, D.M., 2x | 1990 | Knudsen, K.S., 2x |
| 1972 | Aboukhef, M.A. | 1985 | Nichols, S.W. | | Eng, K.C.H. | 1978 | Benjamin, N.N. | 1984 | Walkey, D.J., * | | Finvers, I.G., * |
| 1976 | Maklad, M.S. | | Saqr, W.M. | 1992 | Johnston, B. | | Rao, M.K.N., 3x | 1986 | Walkey, D.J. | | |
| | | | | | Zhang, Y., * | | | | | | |

(f) W. Kilham Memorial Fellowship or Honorary Award*

| | | | | | | | | | | | |
|------|----------------|------|-----------------|------|-----------------|------|-----------------|------|-----------------|------|-------------------|
| 1969 | Dutta, S.R.K. | 1983 | Koskovich, G.N. | 1991 | Bertschmann, R. | 1971 | Aly, G.E.M. | 1982 | Owan, D.M., 2x | 1990 | Knudsen, K.S., 2x |
| 1972 | Aboukhef, M.A. | 1985 | Nichols, S.W. | | Eng, K.C.H. | 1978 | Benjamin, N.N. | 1984 | Walkey, D.J., * | | Finvers, I.G., * |
| 1976 | Maklad, M.S. | | Saqr, W.M. | 1992 | Johnston, B. | | Rao, M.K.N., 3x | 1986 | Walkey, D.J. | | |
| | | | | | Zhang, Y., * | | | | | | |

(g) Others

| | | | | | |
|------|-----------------|---|------|----------------------|--|
| 1969 | Treleaven, D.H. | NRC Post Industrial Experience Research (PIER) Fellowship, 2x | 1983 | Hiskewch, B.R.J. | Can. Assoc. of Physicists Scholarship |
| | Walsh, J. | Standard Oil Foundation Fellowship | | Pahalawalthina, N. | Canadian Commonwealth Scholarship, 5x |
| 1970 | Walsh, J. | B.M. Graduate Scholarship | 1985 | Chebib, S. | Alexander Rutherford Scholarship |
| | Freedman, G.A. | Robert B. Paugh Memorial Bursary | | Nichols, S.W. | Robert B. Paugh Memorial Bursary |
| | Herron, A.G. | Calgary Power Scholarship | 1986 | Green, B.D. | Ralph Steinhauer Award of Distinction |
| 1972 | Dodd, C.L. | Alberta Civil Service Scholarship | 1987 | Bauer, J.M. | Alberta Heritage Foundation Medical Research Studentship, 2x |
| | Patterson, A. | EEE L.F. Hickmell Award & Prize | | | Canadian Commonwealth Scholarship, 2x |
| 1975 | Coldham, D.B. | G.A. Gaherty Memorial Scholarship | 1988 | Rajakaruna, R.M.A.S. | Governor General's Medal |
| 1978 | Turner, L.E. | Robert B. Paugh Memorial Bursary | | Green, B.D. | Canadian Commonwealth Scholarship, 5x |
| 1979 | Angus, A.D. | Hudson's Bay Oil & Gas Co. Ltd. Grad. Fellowship | | Kacelenga, R. | Novatec Scholarship |
| | Bhagwan, J. | Robert B. Paugh Memorial Bursary | 1990 | Olasz, E.B. | Ralph Steinhauer Award of Distinction |
| | Smerek, P.L.R. | Ian M. McKinnon Memorial Fellowship | 1992 | Finvers, J.G. | Governor General's Gold Medal |
| | | | 1993 | Liu, Y. | |

*nx = n years

III. Staff Awards and Achievements

| | | | | | |
|------|------------------------------------|---|------|--------------------------|--|
| 1966 | Trofimenkoff, F.N. | IEEE Premium Award | 1981 | Hope, G.S. | 'Integrated Devices in Digital Circuit Design' John Wiley & Sons, 368 pp |
| 1969 | Comer, D.J. | Faculty of Engineering Superior Teacher Award | | Kendall, E.J.M. | ESS Faculty of Engineering Superior Teacher Award |
| 1972 | Kendall, E.J.M. | Elected Fellow of Royal Inst. Physics | 1983 | Lagu, S. | ESS Faculty of Engineering Superior Teacher Award |
| | Hope, G.S. | IEEE Power Eng. Education Committee Plaque | 1984 | Malik, O.P. | IEEE Centennial Medal and Award |
| 1973 | Chan, W.C. | IEEE Ambrose Fleming Premium Award | | Haslett, J.W. | ESS Faculty of Engineering Superior Teacher Award |
| | Hope, G.S. | NRC Senior Industrial Fellowship | 1985 | Nichols, S.T. | ESS Faculty of Engineering Superior Teacher Award |
| 1975 | Hope, G.S. | Cdn. USSR Scientists Exchange Agreement Fellowship | | Nowrouzian, B. | Myril B. Reed Best Paper Award |
| | Malik, O.P. | Cdn. USSR Scientists Exchange Agreement Fellowship | 1986 | Malik, O.P. | Western Canada Council Merit Award, IEEE |
| 1976 | Kendall, E.J.M. | ASCE PNW Section Western Electric Teaching Excellence Prize | | Barton, T.H. | APEGGA's L.C. Charlesworth Award |
| | Vaughan-Pope, D.A. | NRC Post Doctoral Fellowship | | Hope, G.S. & Malik, O.P. | Appointed 'Consulting Professor' Huazhong University of Science and Technology, Wuhan, PRC |
| 1978 | Barton, T.H. | Elected Fellow of IEEE | 1987 | Malik, O.P. | Elected Fellow of IEEE |
| | Bruton, L.T. | ASCE PNW Section Western Electric Teaching Excellence Prize | 1991 | Berg, G.J. | Recipient of APEGGA's Special Award |
| | Haslett, J.W. & Trofimenkoff, F.N. | IOTC Special Meritorious Award for Innovation in Concept Design and Application | | Bruton, L.T. | Recipient of Ernest C. Manning Principal Award for Innovation |
| | Malik, O.P. | Elected Fellow of IEEE | | Barton, T.H. | Recipient of IEEE's Nikola Tesla Award |
| 1980 | Streets, R.B. | ESS Faculty of Engineering Superior Teacher Award | | | Yugoslav Union of N. Tesla Societies' N. Tesla Gold Medal |
| | Bruton, L.T. | 'RC Active Circuits: Theory and Design' — Prentice Hall, 5.3 pp. | 1992 | Bruton, L.T. | Yugoslav Electric Power Industry's Plaque & Gold Coin |
| | Haslett, J.W. | ASCE Outstanding Young Faculty Award | | | Innovation in Alberta Science Award, ASTech |
| 1981 | L.T. Bruton | Elected Fellow IEEE | | | Leadership Awards Foundation |

Table 5.4 LIST OF ACADEMIC AND SUPPORT STAFF — 1966-91
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ACADEMIC STAFF

| | | | |
|---------------------|-------------------------|--------------------|--------------------|
| Bartley, N. | 1980-1983, 1985-present | Kaler, K.V. S. | 1982-present |
| Barton, T.H. | 1975-1991 (Emerit) | Kendall, E.J.M. | 1970, 1981 |
| Berg, G.J. | 1964, 1988 (Emerit) | Lagu, S. | 1978-present |
| Bhattacharyya, B.B. | 1968-1970 | Malik, O. | 1968-present |
| Bruton, L.T. | 1970-1983, 1985-present | Nichols, S.T. | 1970-1993 (Emerit) |
| Chan, W.C. | 1967-present | Nowrouzian, B. | 1985-present |
| Chan, T. | 1991-present | Rangayyan, R.M. | 1984-present |
| Comer, D.J. | 1966-1969 | Rao, N.D. | 1967-present |
| Eldin, A. | 1989-1991 | Sesay, A. | 1989-present |
| Faloutche, M. | 1986-present | Sheehan, B.S. | 1967-1970 |
| Gilchrist, J.H. | 1975-1978 | Smith, M.R. | 1981-present |
| Grant, T. | 1976-1985 | Stein, R.A. | 1968-present |
| G.J. | 1989-present | Streets, R.B. | 1967-present |
| Hamza, M.H. | 1968-1991 | Trofimenkoff, F.N. | 1966-present |
| Haslett, J.W. | 1970-present | Turner, L. | 1979-present |
| Hope, G.S. | 1967-present | Vaughan-Pope, D.A. | 1976-1977 |
| Irvine-Halliday, D. | 1983-present | Zissos, D. | 1979-1982 |
| Johnston, R.H. | 1970-present | | |

SUPPORT STAFF

| Secretarial | | Technical | |
|------------------------|--------------|-------------------|--------------|
| Fausser, E. | 1978-1979 | Aiam, J. | 1977-1986 |
| Fox, E. | 1967-1976 | Anand, B. | 1983-1988 |
| Fraser, J. | 1987-present | Beh, D. | 1971-1972 |
| Grajewski, I. | 1969-1973 | Betts, D. | 1968-1974 |
| Holmes, L. | 1981-1987 | Csanyi-Fritz, G. | 1969-1983 |
| Howard, S. | 1967-1974 | Dunlop, E. | 1968-1971 |
| Jancowski, E. | 1970-1972 | Evanik, E.G. | 1981-present |
| Kabatoff, A. | 1968-1969 | Fitzmaurice, S. | 1981-1984 |
| Knight, F. | 1976-1990 | Flaman, Warren S. | 1979-present |
| Kowalchuk, N. | 1974-1983 | Geerlign, J. | 1971-1981 |
| Lok, E. | 1984-present | Hancock, G.C. | 1974-present |
| MacDowall, A. (Boonov) | 1975-1984 | Harrington, G. | 1983-present |
| McGully, K.J. | 1972-1974 | Kovach, R. | 1975-1977 |
| Millan, I. | 1982-1988 | Leikem, S. | 1989-present |
| Milner, S. | 1974-1975 | Matheron, V. | 1973-1975 |
| Nelson, B. | 1978-1981 | Mulder, L. | 1976-1977 |
| Peshke, L. | 1985-1991 | Murtagh, J. | 1977-1979 |
| Reimer, R. | 1989-1991 | Nordquist, A.E. | 1966-present |
| Reinelt, V. | 1990-present | Phillips, A. | 1967-1983 |
| Rundle, A. | 1982-present | Risdahl, P. | 1968-1971 |
| Sinclair, D. | 1971-1983 | Sauverwald, T. | 1984-1989 |
| Struthers, S. | 1968-1970 | Scharf, G. | 1987-present |
| St. Pierre, D. | 1979-1982 | Thomson, R.M. | 1988-present |
| | | Waish, P.J. | 1967-present |
| | | Yeung, B. | 1986-1987 |



Plate 5.43 Some serious discussion at the Open House Display in the Department of Electrical Engineering to R. Fred Trotmenkoff, Laurence Turner, Michael Svihura, Peter Grauman, with pointer, and Jim Hasielt (seated) Oct. 17, 1991



Plate 5.44 The Hon. Ernest C. Manning presenting the 1991 Manning Awards, principal prize to Prof. Len Bruton, U. of T. Toronto, Sept. 25, 1991

A Place of
INGENUITY

VI.

Department of
MECHANICAL
ENGINEERING

THE SILVER ANNIVERSARY

For the Department of Mechanical Engineering the anniversary year brought about changes more dramatic than any event since 1967 the year it settled into its home the B Block. It was in the summer of 1991 that Mechanical Engineering moved from its old home into new quarters, the newly leased *Petro Canada Building*, just north of and across the street from the Mechanical Engineering Wing (see Plate 6.1). By September, the Department was operational in its new environment and mechanical engineering courses were offered for the first time in the new building.

The move came about as a result of the successful conclusion of negotiations between Petro Canada and The U of C, initiated by the Department and the Faculty in 1983-84. In October 1986, Dr F.A. Campbell, V.P. (Priorities and Planning), became involved but agreement could not be reached and negotiations were broken off in June 1987. Activity on this mat-

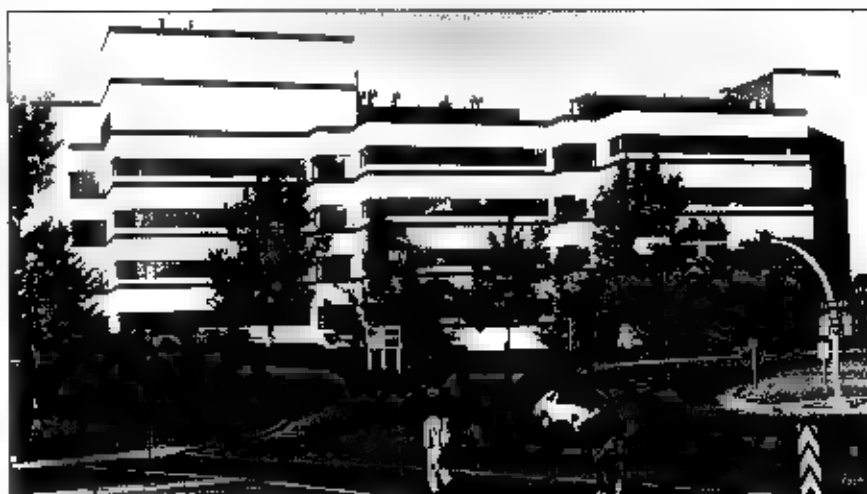


Plate 6.1 The Petro Canada Building, Mechanical Engineering's New Home as of July 1991

ter was resumed in Sept. 1990, by Dr E. Rhodes, the newly appointed Dean of Engineering. By December the Minister of Advanced Education had agreed to provide the funds required for the operation of the building after which negotiations switched into high

gear. Within a few weeks the lease arrangements were settled and were approved on behalf of the Board by its Executive Committee on Feb. 5, 1991. The lease agreement was signed a week later for a 10 year period at a nominal annual fee effective April 1.



a Five of the 6 man Club Mech team's emerging from a cloud of snow as they are catapulted along their 15 m trajectory after bringing their machine to a stop at the push line within an incredible 1.70 m. During their 12.5 sec. winning run down the 200 m course their velocity was clocked at up to 51 km/hr. The team scored first in the categories of Fastest Run, Fastest Combined Time, Best Break ng and the coveted Best Overall. Team members visible are (from front to rear) Michael Johnson (right), Kevin Baxter (left), Rob Watson (riders) and Murray Bell (the driver). The 4th rider, Jeff Saponja is between Rob and Murray and is not visible. The 6th member of the team, Steve Hultema, as pusher, was left behind, just 1.0 m inside the starting line where the driver jumps onto the accelerating toboggan and the pusher stays behind in addition to helping to accelerate the machine, the driver also looks after steering and hitting the brakes. The remaining members of Club Mech were Tom Bern, Trevor Ennos, Wayne Chorney, Brian Petersen and Hans Sorensen, with the latter spearheading the design and construction of the winning machine.

Plate 6.2 The 16th Annual Great Northern Concrete Toboggan Race, GNCTR 90 was held on Feb. 17, 1990 at Canada Olympic Park, Calgary. It was hosted by The U of C's Civil Engineering who had won the race in Vancouver in 1989. The GNCTR is primarily a Civil Engineering event inaugurated in 1975 near Red Deer (see Plate 4.24). Since then it has been an annual highlight of student activity steadily gaining in popularity. Students from Mechanical Engineering at The U of C first participated in the race in 1979. Our Club Mech entry, in competition with teams from 47 Canadian and nine U.S. Civil Engineering Schools, won the race and were declared unofficial champions of GNCTR 90, a title reserved for the best Civil Engineering team.



b Members of the Club Mech Group, immediately after their winning run, celebrate. Seated: Kevin Baxter, Jeff Saponja, Rob Watson. Standing: Hans Sorensen, Brian Petersen and Mike Johnson. Wayne Chorney is standing behind Mike's right shoulder, with Wayne's cap showing. Club Mech was sponsored by Canadian Fracmas, Esso, Esso Resources Canada Ltd., Shell Canada Resources Ltd. and the Department.

Mechanical Engineering · 1991

1991. For operating costs of the building, Alberta Advanced Education added \$324 000 for fiscal 1991/92 to the university's budget with \$180 000 per year thereafter for 9 years.

After the lease was signed, Ted Rhodes was also successful in getting the senior administration of the institution to respond to the critical space shortage existing in the Faculty and assign the entire building to Engineering. In turn, and as announced at the Departmental Council meeting on Wednesday, May 29, 1991, he decided to make the new facility available to Mechanical Engineering thereby relieving, in large part, its space shortage under which it operated for almost 2 decades.

Equally eventful for Mechanical Engineering was the year 1990. It began with a student highlight in February when a group of 10 seniors and a technical staff member, Michael K. Johnson, decided, and with the support of the Department and industry, proceeded to field a team in the 16th Annual Great Northern Concrete Toboggan Race, GNCTR '90. The 6-member team won the race, established new records for GNCTR, and was declared *unofficial champion* of the event (see Plate 6.2).

For the Department as a whole, the decade also began on a *high note* with the graduation of its first CIM class. On June 6, 1990, at Spring

Convocation, 18 of the 72 BSc graduates from Mechanical Engineering were members of the first class in the Department's new senior year specialization in *Computer Integrated Manufacturing*. Six of the graduates were females, one of them a member of this first CIM class. There were also 6 graduate degrees awarded to mechanical engineering students at that convocation, 1 PhD and 5 MSc degrees. The Department saw 12 more of its students graduate at Fall Convocation on Nov. 9th, including 7 BSc, 1 PhD, 3 MSc and 1 MEng candidates for a total of 79 undergraduate and 11 graduate degree recipients in 1990 (see Fig. 6.1). Four of the 7 BSc graduates were also members of the first CIM class, one of them a girl. Thus 1990 was a *near record year* in terms of number of undergraduate and graduate degree recipients and number of female graduates (see Figs. 6.3 and 6.5).

Convocation statistics for 1991 are also shown on Fig. 6.1 where the BSc graduates include 11 students from the CIM Minor. The graduate degree recipients comprised 5 PhD, 3 MSc and 2 MEng candidates.

Undergraduate and graduate enrollments are summarized on Fig. 6.2 where one male student in the 5 year



Saporin
Jeffrey Charles
1990

Wilton-Clarke
Harry James
1991

Sanchez
an
1992

Plate 6.3 The Mechanical Engineering APEGA Gold Medal winners 1990, 1991, 1992

combined BSc-BA programme is included with the 78 junior students. The senior class size for 1990 included 78 regular and 3 part-time BSc and 1 BSc/BA students. The departmental *near record senior enrollment* of 95 attained in 1991 consisted of

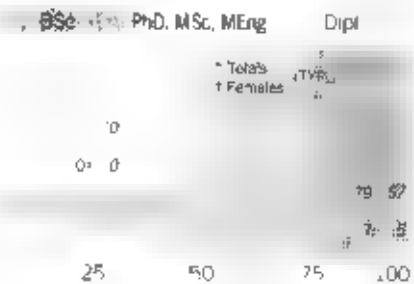


Fig. 6.1 Convocation Statistics for Mechanical Engineering 1990 with 1991 figures in italics

91 full-time and 3 part-time BSc and 1 BSc/BA registrants. Fourth year CIM Minor classes of 15 and 16 students for 1990 and 1991, respectively, are included in these numbers.

The graduate student enrollments shown include 19 full-time and 1 part-time PhD candidates for both 1990 and 1991 with 2 females in a full-time programme. Two of the male students were Manufacturing Engineering registrants. There were also 22 full-time MSc and 7 part-time MEng candidates in course during 1990/91 with 2 of the MSc students being female and 5 students specializing in manufacturing engineering. In 1991/92 there were again 22 full-time MSc students, 4 of whom were women, and 5 were students in the Division of Manufacturing Engineering. Four full-time and 8 part-time MEng candidates round out these statistics, with the lat-



Plate 6.4 Mechanical Engineering students in front of their New Home on a break between classes. View towards N.E. L to R: P.A. Ivers, S. Giacomini, J.M. Sharp, R.R. Cumberland, T.T. Wagner. September, 1991

ter group including 1 female and 1 manufacturing engineering student

The Department was pleased to see that not only the *quantity* but also the *quality* of its student body remained high as it entered the 1990's. To underpin this statement one needs only to examine the scholarships, fellowships and awards won by mechanical engineering students. Thus for example the APEGGA Gold Medal winners for the period 1990-92 were Jeffrey Charles Saponia, Harry James Wilton Clark and Ian Sanchez respectively (see Plate 6.3). These outstanding young engineers, all 3 of whom graduated with *distinction* were also awarded numerous other scholarships and prizes. For example the 1991 Athlone-Janier Engineering Fellowship was won by J.M. Wilton

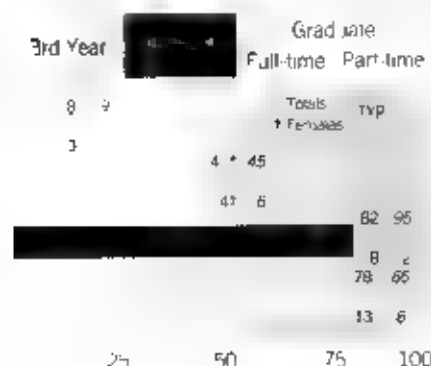


Fig. 6.2 Registration Statistics for Mechanical Engineering, Fall 1990 (with 1991 figures in italics)

Clark. Some of the many other *high-fliers* of this 3 year period, with several scholarships to their credit, include Eric John Cavele, Brenda Merran Leeds, Bruce Andrew Miner, Keith



Plate 6 The Mechanical Engineering secretarial staff enjoying the New Environment. L to R: S. E. Kruger, K. A. Hildesheim, Barbara P. Evans (front), M. B. Berry, K. M. Goss, C. E. Culverley, K. Kuervers. Nov 1991

Andrew Nodwell, David Michael Rossiter, Mark Robert Sawa and Antony Derrick Eaton van der Vliet, all of whom graduated with *distinction* (see also Table 6.3). Amongst the graduate students, some of the most notable prize winners and holders of several major scholarships per year include Marvin Weiss, Gerald Cole, Janet Ronsky, David Diakow and James Bugg, the latter being appointed Assistant Prof. at the University of Saskatchewan prior to completion of his degree requirements. Other graduate student highlights include the prize won by Ian J. Potter in the 1991 Inst. of Electrical and Electronic Engineers (IEEE) international student paper competition at the University of New Hampshire Sept. 23-25, 1991. Much media attention was attracted by Mr. Daryl J. Caswell's work on artificial church

bells (see Plate 2.7 and Table 6.3).

The GNCTR '90 was but one of many extracurricular activities in which mechanical engineering students participated and chalked up *high scores*. As a group, the M.E. Students Society (MESS) handily won the 1990 Students Union *Bloody Cup* in the annual Red Cross blood donation drive. They also placed first in the Engineering Students Society Memorial Scholarship fund raising campaign. As individuals, they served on the executives of student organisations or were responsible for the planning and execution of key student programmes and events. For example, Steven J. Giacomini was President of ESS (1991-92). His successor, J. Kyle Keith, also served as President of the First and Second Year Engineering Students Society (FSYES) before entering the Department. Amy Joy Stevenson was member of the FSYES Council and Philipp A. Myers was organizer of the 1990 *Queen Week* (renamed Engineering Week in 1989-90) (see Plate 6.4).

In addition to the above noted departmental student body numbering 209, Mechanical Engineering also provided educational opportunities to many of the Faculty's 162 unclassified and 21 visiting students during 1990-91. The Department also looked after its share of teaching in the common core, being involved in 20 freshman and sophomore courses. In carrying out these teaching as well as research and service activities, the 21 full-time academics relied on the help of 7 secretarial and 11 technical support staff.



Plate 6b The Mechanical Engineering technical staff. L to R: R. W. S. Stephens, R. W. Gustafson, N. Wright, B. R. Saunders, A. D. Moehle, R. Taylor, and B. Wilkinson. L. to R. M. R. Wilkinson, B. R. Ferguson, R. S. Daley, J. J. May 6, 1991

and a group of 21 visiting professors, scholars, research associates, assistants, PDF's and sessional instructors (see Table 6.1 and Plates 6.5 and 6.6). Dr. Joseph S. deKrasinski continued to be active in teaching and research more than a decade after becoming the Faculty's first Professor Emeritus (see Plates 6.10 and 6.20). In addition, and in accordance with longstanding departmental policy, full-time graduate students were involved in the undergraduate teaching process as Graduate Teaching Assistants, GTAs.

The momentum associated with the successful launching of the CIM Minor programme in September 1989 was reinforced by the approval, in principle, of the BSc Manufacturing Engineering programme proposal at the Departmental Council meeting on Nov. 16, 1989. The idea of a *Division of Manufacturing Engineering* was also raised at that meeting by the CIM Group, spearheaded by Dr. D.H. Norrie. Establishment of the Division was approved by the Department at its meeting on Apr. 21, 1990, after which Doug Norrie was selected, and within a few weeks appointed Associate Head and Head of the Division effective Oct. 1, 1990. On the same date Dr. R.D. Rowe became Associate Head (Graduate Studies, (see Plate 6.7).

The BSc programme proposal was taken to EFC on Nov. 21, 1989 where it was endorsed and referred to the Academic Review Committee. On June 1, 1990, it was brought back and approved in principle, with suggested minor modifications. The revised document was given final approval by EFC on Feb. 6, 1991 after which it



G.T. Reader R.L. Bechtold K.M. Goss D.H. Norrie R.D. Rowe

Plate 6.7 The Mechanical Engineering administrative team 1990-91

was considered and endorsed by various institutional committees, by GFC and by the Board of Governors (see Appendix H for details).

As the staff lists in Tables 6.1 and 6.4 indicate, there were a number of academic and support staff changes during the first 2 years of the 1990's. The decade was *rung in* for the Department with the departure of its longest serving staff member, Dr. A.G. Doige, who joined the Dept. of Mechanical Engineering at the U of A on Sept. 1, 1959. He transferred to the new Calgary Campus in Sept. 1960. Alan Doige decided to take early retirement and move to Victoria with his family (see Plates 2.21 and 6.8) in recognition of his many outstanding contributions to the Department, the Faculty and the University. He was appointed Professor Emeritus effective Jan. 1, 1990. Prof. Doige's retirement was preceded by that of another *old-timer*, Dr. Eric W. Johnson, on June 30, 1989, after he had spent nearly 19 years in the Department and had served as Assoc. Dean (Student Affairs) from 1975 to 1985. A third member of the solid mechanics group, Dr. Sadik Dost, who had joined Mechanical Engineering in Aug.

1980, resigned and left for Victoria on July 31, 1989.

The academic vacancies created by these retirements and the resignation were filled by 3 outstanding young scholars, Drs. Xingyuan Mao, Peihua Gu and Paul Rogers, 2 of whom were appointed as Assist. Prof. effective Aug. 21, 1989, Sept. 1, 1990 and July 1, 1991 respectively. The senior administrative vacancy was filled through the appointment of Dr. Graham T. Reader from the Naval Engineering College in Plymouth as Prof. and Head effective July 1, 1988 (see Plate 6.7). The most recent arrival is Dr. Luc Bauwens, who joined the Department on Jan. 1, 1992.

Luc Bauwens had hardly settled into his new surroundings when an opportunity came along for him to test his prowess in supercomputing. He was asked to enter the 1992 *Supercomputer Challenge* organized as part of the Canadian Supercomputing Symposium by the Dorval Computer Centre of the Atmospheric Environment Service, Dept. of the Environment. The Centre had recently installed one of the world's most powerful supercomputers, an NEC SX-3/44 with 4 processors. The main objective of the international competition was to achieve the highest possible processing speed utilizing the machine's multitasking capabilities. Dr. Bauwens used his computer model of a ramjet combustor which he had developed earlier and which had successfully run on a single processor Cray supercomputer. He adapted his programme to the NEC and won 3rd place in the competition and the highest standing amongst academic participants.

There were also a number of adjunct appointments or appointment renewals during 1990-91. One of these, effective Oct. 1, 1991, involved Mr. J.V.P. Panilio, a 1982 MSc graduate from the Department who joined the



Plate 6.8 The Doiges at Prof. A.G. Doige's retirement reception on June 19, 1989 at the U of A Faculty Club. L to R: LeBlond, Marie-Josée Finamore, Allen Jennings, and Laune Maureen.

University's Injury Research Unit, IRU in Sept. 1983. The IRU grew out of an initial 1 year contract between The U of C and Transport Canada, signed March 26, 1976 for a study of the effectiveness of motor vehicle safety standards and devices. The Project was headed by Dr. John H. Read until July 31, 1991 and was housed in the Dept. of Community Health Sciences. The initial contract was renewed several times and the name of the unit has also changed over the years. Vladimir Panilio was selected as Dr. Read's successor effective June 1, 1992 the day on which the IRU became associated with the Department of Mechanical Engineering, with the support and approval of Transport Canada.

Of the many other staff highlights for the anniversary period let us note the following examples:

- Dr. Marcelo Epstein's inspired teaching was acknowledged through a 1992 *Teaching Excellence Award* of The U of C Engineering Students' Society ESS (see Plate 6.9)
- In recognition of outstanding service as Faculty Advisor at The U of C and for other valuable services in the Western Region Prof. A.A. Torvi was selected recipient of the Canadian Society for Mechanical Engineering *Certificate of Service*, presented at the 2nd Annual CSME Forum in Montreal June 2, 1992
- Dr. D.H. Norrie's continuing involvement in computer related research and teaching was underlined by the renewal on Sept. 1,

1991 of his appointment as Adjunct Professor of Computer Science, Faculty of Science, for a second 3 year term.

- Dr. G.A. Karim's longstanding involvement in the activities of The U of C Student Chapter of the Society of Automotive Engineers was recognized through their *International Outstanding Faculty Award* presented at the SAE International Congress and Exhibition in Detroit, March 3, 1992 where he attended as guest of the Society
- At the invitation of the JIN Dr. G.T. Reader spent 2 weeks in India as LN advisor to the Indian government. During his stay he gave a keynote address at the First National Conf. on Rural Electrification held in New Delhi July 18, 1990. His tour was followed up by a visit of Indian Government scientists to the Department in Nov. 1990
- Dr. G. Walker's expertise in Stirling engines and cryocoolers continued to be in high demand. By invitation he presented short courses, seminars and workshops on latest developments in these fields at the University of California, Los Angeles (Jan. 8-12, 1990; Jan. 7-11 and August 12-16, 1991; Feb. 10-14, 1992) and at the Inter-University Centre, Dubrovnik, Yugoslavia (May 6 and 7, 1991). A highlight was his lecture on 'Recent Advances in Miniature Cryocoolers' at the Missile Defence Headquarters of the Ministry of Defence in Tel. Aviv May 3, 1991



Plate 6.9 Prof. Marcelo Epstein is accepting the 1992 Engineering Students' Society Teaching Excellence Award from Mr. Garry Galinsky, Senior in Mechanical Engineering The Mainbrace April 7, 1992

- Significant contributions were made by the staff in organizing major international and national conferences. For example, Drs. G.A. Karim and I. Wierzbna were co-organizers of the Int. Combustion Institute, Canadian and Western States Sections, Spring Technical Meeting, Banff, April 28-May 2, 1990. The 5th Int. Stirling Engine Conference ISEC, held May 8-10, 1991 in Dubrovnik, was organized with Dr. G. Walker as Co-Chairman and Dr. G.T. Reader as Programme Chairman. A highlight for the Division of Manufacturing Engineering was the highly successful *Int. Conf. on Object-Oriented Manufacturing Systems*, held at The U of C, May 4-6, 1992 and organized under the Chairmanship of Dr. D.H. Norrie with the staff of the Division. Drs. O.R. Fauvel, P. Gu, P. Rogers and Prof. A.A. Torvi responsible for various aspects of the conference
- Dr. P.G. Glockner was named Honorary Congress Chairman of the Thirteenth Canadian Congress of Applied Mechanics, CANCAM '91 held at the University of Manitoba in Winnipeg, June 3-6, 1991
- Dr. D.H. Norrie was invited to be the only university representative on the 11 member Canadian *Advanced Manufacturing Technology (AMT) Fact Finding Mission to Japan*, March 23-27, 1992. During its 5 day stay in Japan, the Mission was involved in 5 major industrial

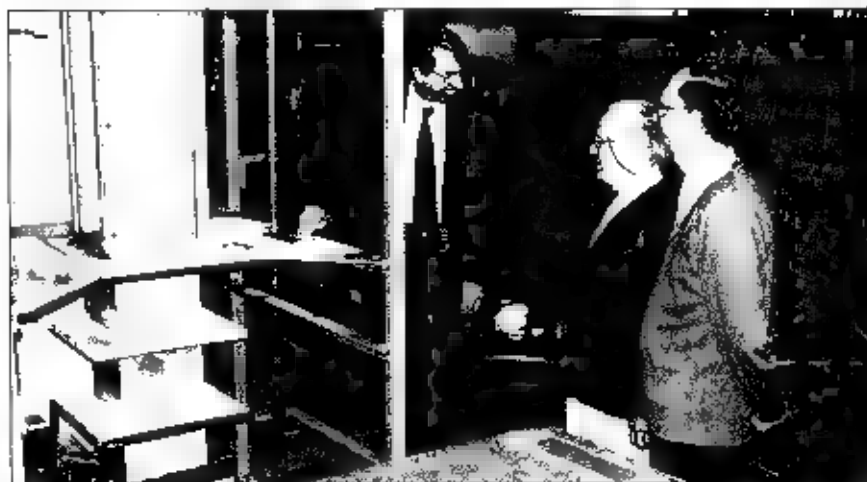


Plate 6.10 - Members of the Fluid Dynamics Group are discussing the use of the vertical flow visualization chamber for the study of vortex separation on underwater propellers. L to R: Drs. L. Bauwens, S. de Krasinski, and R.D. Rowe 1992

briefings and 14 site visits, including a visit to Hitachi's Production Research Centre with a demonstration of their customer based ordering and planning system, and a stop at the Fuji Electric Co. in Otawara.

As is clear, many of these highlights are related, directly or indirectly, to the research activities of the staff. Other indicators of the Department's research strength, depth and breadth include the number and quality of graduate students, noted above, the external research funding (\$0.82 million for 1990/91) and the spectrum of research activity and interest of individual staff members and research groups. The Department's main research groups include the following:

- The Fluid Dynamics Group, consisting of Drs. L. Bauwens, J. S. de Krasinski, J. A.C. Kentfield and R.D. Rowe (see Plate 6.10) are involved in numerical modelling of vortex dynamics and turbulence, non-steady compressible flow, laser Doppler anemometry and environmental fluid and aerodynamics, including wind tunnel studies of mountainous terrain, toxic gas diffusion and turbulent dispersion, stack pollution and bubble plumes and subsea oilwell blowouts.
- The Materials Science Group including Drs. O.R. Faive, X. Mao and W.J.D. Shaw (see Plate 6.11) are studying problems in rock mechanics and mining, fracture mechanics, stress and electrochemical corrosion, creep and toughness, welding, mechanical

properties, fractography, polymers, superplasticity, fatigue, metallography, composites, ceramics and aluminium alloys.

- The Combustion Group, comprising Drs. G.A. Karim, J.A.C. Kentfield, P.J. Vermeulen and Wierzbka (see Plate 6.12) are carrying out research on a broad spectrum of thermodynamic and combustion problems including hydrogen and natural gas fuels, internal combustion and diesel engines, exhaust emissions, tar sands combustion, fire spread and safety, gas turbines, pulsed and acoustically controlled combustors.
- The Stirling Engine Group, consisting of Drs. L. Bauwens, O.R. Faive, G.T. Reader and G. Walker (see Plate 6.13) are investigating Stirling cycle technology, Stirling engines and energy systems, underwater power systems, exhaust gas management, energy conversion, cryogenic cooling systems and numerical modelling of Stirling engines, Stirling refrigerators and cryocoolers.
- The Solid Mechanics Group including Drs. K.L. Chowdhury, M. Epstein, P.G. Glockner, S.A. Lukasiewicz, E.C. Mikulcik, M.C. Singh and O.G. Vinogradov (See Plate 6.14), are dealing with fundamental and applied aspects of solid and continuum mechanics, non-linear constitutive theory, cables, membranes, inflatables, plates and shells, stability, finite elements, wave propagation, the use of symmetry and group-theoretic meth-



Plate 6.11 Members of the Materials Science Group are discussing results from a corrosion study on steel alloys. The project is funded by Esso Imperial Oil Ltd. and EMR through a 3 year grant of \$170,000. L to R: Miss A. Somers, Drs. X. Mao and W.J.D. Shaw.

ods, dielectric and piezoelectric materials, multibody dynamics and ice flows and modeling the stability and vibrational response of road vehicles.

- The Manufacturing Engineering Group, consisting of Drs. O.R. Faive, P.G. D.H. Norrie, P. Rogers and Prof. A.A. Torvi (see Plate 6.15) are focusing on problems of computer integrated and advanced manufacturing technologies, including computer-aided design/learning, CAD/CAE, integrated process planning, robotics, artificial intelligence and intelligent agent systems, production planning and control, flexible manufacturing systems, quality management and manufacturing strategy.
- The Design Group, including Drs. O.R. Faive, J.A.C. Kentfield, S.A. Lukasiewicz, X. Mao, G.T. Reader, P.J. Vermeulen, O.G. Vinogradov and G. Walker are involved in the design of rock cutting and tunneling equipment, wind turbines, solar power devices, photoelastic stress analysis and oil drilling equipment, marine and submarine propulsion systems, miniature cryocoolers using micro- and nanotechnologies, and the interrelationship between design and reliability.
- The Measurement Control and Instrumentation Group, consisting of Drs. J.A.C. Kentfield, S.A. Lukasiewicz, E.C. Mikulcik, P. Rogers and P.J. Vermeulen are research-

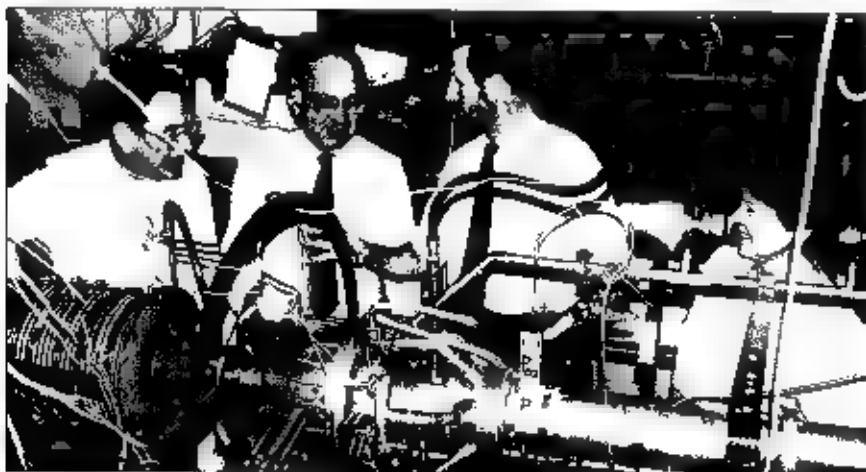


Plate 6.12 Members of the Combustion Group are discussing the operation of the acoustically controlled combustor. L to R: Drs. J.A.C. Kentfield, G.A. Karim, P.J. Vermeulen, Wierzbka. 992

ing problems on robotics, automatic control systems, feedback and predictive techniques and stress measurement systems.

In addition to the above research groups and areas, the academics in the Department are also studying problems in a number of other specializations including structural damping, gaseous explosions, musical acoustics and noise pollution. Dr. M. Epstein, 3 adjunct appointees from Physical Education (Drs. J. Engelsberg, W. Herzog and B. M. Nigg) and 10 graduate students from Mechanical Engineering are involved in biomechanics research dealing with such topics as muscular force production and control and the application of musculoskeletal mechanisms to the healing and prevention of injuries and disease. For his contributions to and involvement in these research programmes carried out in the Human Performance Laboratory of the Faculty of Physical Education, Marcelo Epstein was appointed Adjunct Prof. of that Faculty on July 1, 1992.

Such a broad spectrum of research interests and activity, together with the quality of the graduate students and coworkers and the record levels of external funding, result in numerous outstanding research events and initiatives including the following highlights:

- The rapid growth in research activity and stature of the Division of Manufacturing Engineering is underlined by: (i) a \$0.5 million equipment donation from Hewlett

Packard (Canada) Ltd. to equip a new research laboratory on intelligent manufacturing, (ii) conclusion of negotiations with NRC on 3 yearly agreements for collaborative research on intelligent agents with their Institute for Information Technology, the first of which was signed Aug. 30, 1992 and funded at \$45,000 annually, (iii) signing an agreement on June 22, 1992 with the Alberta Research Council (ARC) for joint R & D in manufacturing engineering.

- Dr. J.A.C. Kenfield's R & D work on wind turbines resulted in a design for a water pumping unit being produced by Dutch Industries Ltd. of Regina, Sask. More than 50 machines have been exported to the U.S. and to various countries in Africa. Turbines built according to his latest design are undergoing testing at several locations, including the EMR/ERF Alberta Renewable Energy Test Site (ARETS), at Pincher Creek, Alberta. He was asked to review 3 proposals for wind-turbine farms near Pincher Creek, all 3 of which are under construction (1993). The largest of these is a 10 Mw \$12.0 million project on the Peigan

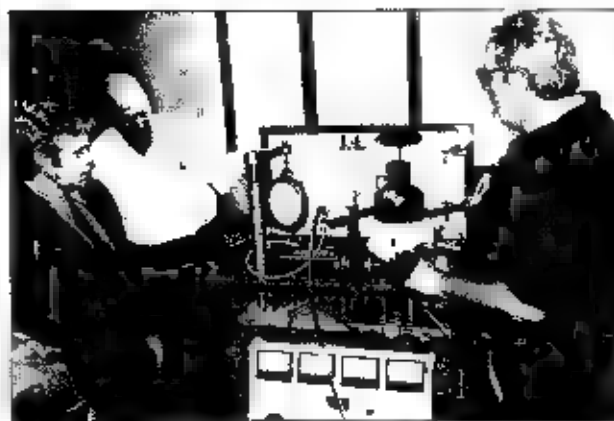


Plate 6.3 Members of the Stirling Engine Group are discussing a test procedure for the Ross-Stirling engine, which is shown on its test bed and was built in the Faculty machine shop. L to R: Drs. G.T. Reader, O.P. Fauvel and G. Walker. 1992

Indian Reservation. A 9 Mw farm is being installed near Coweys Ridge. For his 'outstanding contributions to the development of wind-energy technology' Dr. Kenfield was selected recipient of the *R.J. Templin Award of the Canadian Wind Energy Association*, presented at their annual meeting in Ottawa, Nov. 3, 1992 (see Plate 6.81).

- Dr. Marcelo Epstein was founding member (1990) and Chairman (1991) of the *Vocal Arts Acoustics Research Group*, vAARG, an interdisciplinary group involving members from 5 Faculties at The U of C. The Group is involved in research and clinical work dealing with problems of theoretical and architectural acoustics, acoustic measurements, psychoacoustics (perception), the anatomy and physiology of the ear and vocal chord problems due to singing and public speaking. Interest in the Group's activities was underlined by a \$60,000 NSERC special equipment grant. Support also came from the Calgary Rotary Club and the Canadian Voice Care Foundation.
- In recognition of his contributions to Stirling cycle technology and its application in underwater power systems, Dr. Graham T. Reader was selected as recipient of the *Japanese Society of Mechanical Engineers Medal*, presented at the 5th ISEC in Dubrovnik, May 1991.
- Dr. G.A. Karim, with a team of 13 students and co-workers, continued his studies on a wide range of combustion problems, including the partial oxidation of methane for



Plate 6.14 Members of the Solid Mechanics Group are enjoying spring time in front of the new Mechanical Engineering Building. L to R: Drs. E.G. Mikuklik, O.G. Vinogradov, M.C. Singh, S.A. Lukaszewicz, M. Epstein and P.G. Giociner. K.L. Chowdhury, absent. May 5, 1992

the production of hydrogen or synthetic gas and the combustion of low heating value fuels. It was financed by Alberta Energy (\$75,000 1990-91) and by Esso Resources Ltd (\$30,000 1991-94) respectively. The latter award was highlighted by Imperial Oil Ltd's *Research Excellence Certificate*. His projects on limits of knock-free output from dual fuel and gas fueled engines were supported by major NSERC Strategic grants (\$127,000 1988-91, \$121,000 1991-94). In some of his studies he cooperated with Dr. Wierzb.



Plate 6 Members of the Manufacturing Engineering Division are operating the traditions of a modern machine, a Computerized Petroleum Engineering using the equipment's Multisync computer. The machine is a large, complex piece of industrial equipment with a control panel and a large screen displaying a graph. The machine is a large, complex piece of industrial equipment with a control panel and a large screen displaying a graph. The machine is a large, complex piece of industrial equipment with a control panel and a large screen displaying a graph.

- Dr. W. J. D. Shaw continued to be the most successful researcher in the Department in terms of obtaining industrial support for his projects. For example, his studies on corrosion of aluminum alloys and on stress corrosion cracking were funded by AMOCO Canada Petroleum Co. Ltd. (\$30,000) and by Shell Canada Ltd. (\$30,000) respectively. Pathbreaking research with his group of 11 graduate students, 3 visiting scientists and 2 post-doctoral fellows on mechanically alloyed polymers was financed by a \$140,000 NSERC University-Industry Research Grant (1990-93) with the inst. for Chemical Science and Technology ICST, providing the industrial support. A study on the evaluation of the effects of cryogenic heat treatment on tool steels was made possible through an NSERC Industrial Research Assistance Programme (RAP) grant (\$15,000) in collabora-

tion with Ram Resources Assurance Management Ltd. Funding was also obtained from Esso Resources Canada Ltd. (\$10,000) for research on basic pitting mechanisms from AOSTRA (\$10,000) for stress corrosion cracking studies and from EMR (\$12,000) for work on pitting corrosion of pipeline steels. The latter of which was a joint project with Dr. X. Mao. A state-of-the-art energy dispersive spectrometry system EDS was acquired through a \$112,735 NSERC major equipment grant for which Bill Shaw was the principal applicant. His exceptionally high performance level is underlined by

the fact that in addition to his research activities he also set a time records in graduate teaching by offering 6 graduate courses during 1991 lecturing in 2 and supervising and coordinating the students studies in 4 reading courses.

- Barely 2 years after his appointment, Dr. X. Mao has established his own research group with substantial external funding and with 4 graduate students and a PDF under his supervision. His studies on stress corrosion cracking of pipeline steels in soils are supported by 3 year grants from EMR (\$10,900 p.a.), and Esso Resources Canada Ltd. (\$10,300 p.a.) with the latter being highlighted through Imperial Oil Ltd's *Certificate of Research Excellence*. A project on pitting corrosion at locations of coating disbondment is funded by a 3 year (\$18,000 p.a.), EMR grant. A joint study with Bill Shaw on stress corrosion cracking of steels in coal gasification environments spearheaded by Dr. Mao, is administered through Alberta Coal Research and is financed by a 3 year \$172,000 grant from a consortium including Alberta Energy, Alberta Power, CANMET, Transalta Utilities Co. Ltd. and the Nova Scotia Power Co. Ltd.

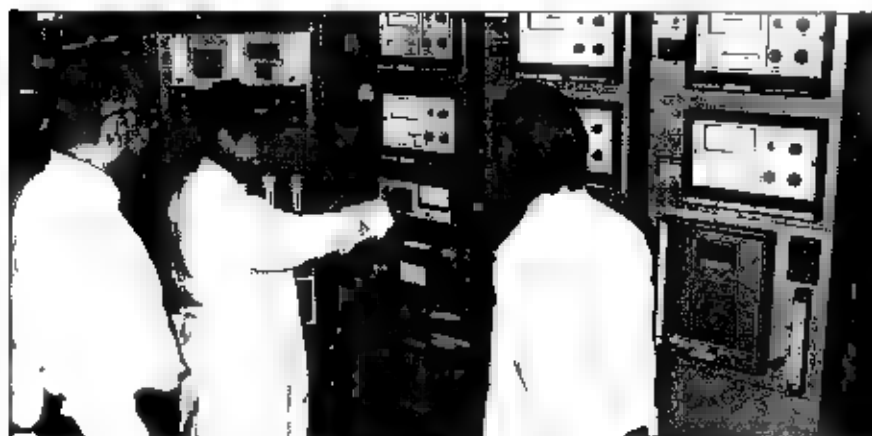


Plate 6.10 Professors C. A. Karim and Wierzbicki are discussing with their Research Assistant, Miss A. L. Stasiak, some test results related to stability of a system. The image shows three people in a laboratory setting, looking at a piece of equipment. The image shows three people in a laboratory setting, looking at a piece of equipment.





Photo: The Peltó Canada Building

THE MECHANICAL ADVANTAGE

A mechanical engineering presence on the Calgary Campus was first established in September 1960. Two young staff members from the Dept. of Mechanical Engineering at the U. of A. Alan G. Doige and Robert H.B. Hebbert (see Plate 2.21) were transferred to Calgary to help with the increased course offerings resulting from the introduction of the 2nd year engineering programme. Both of them had been Sessional Instructors since Sept. 1959 and were appointed Asst. Prof. effective Sept. 1, 1960.

In addition to lecturing in 1st and 2nd year full-year courses, the two staff members initiated some research activity. Bob Hebbert began a study on hydraulic transport of sand and presented a paper on *Moving Hydraulic Jumps in Fluidized Solid Systems* at the ASME EIC Hydraulics Conference in Montreal, May 10, 1961, a paper co-authored by R.W. Ansley, his colleague at the U. of A. Alan Doige spent the summer months of 1961 at the Structural Division of NRC's National Aeronautics Establishment in Ottawa where he carried out research on the fatigue life of aluminum sheets at elevated temperatures.

This 2 man mechanical engineering staff complement was cut in half when Alan Doige went on an *assisted leave of absence* in Sept. 1962 for Ph.D. studies at Purdue University

where he was awarded an R.W. Herrick Foundation Fellowship. The remaining mechanical engineering staff member, Bob Hebbert, resigned effective June 30, 1963, and moved with his family to Perth in Western Australia. To replace him, Mr. Daniel W. Pashnak was asked to start his academic career at the Calgary campus during the 1963-64 session. His appointment as Asst. Prof. of Mechanical Engineering at the U. of A. effective Sept. 1, 1963, had only been approved by the Exec. Committee of the Board a few months earlier, on May 28. He moved to the U. of A. in Sept. 1964.

The first mechanical engineering continuing staff appointee of the new Division of Engineering at Calgary was Dr. James E.S. Venart who joined the *Calgary engineering team* as Asst. Prof. on Sept. 1, 1964 (see Plate 2.32). Being the only full-time engineering staff member with a thermo-fluids background, in addition to offering undergraduate courses in his field, he also carried a major share of the workload related to the planning of detailed course outlines for the 8 thermo-fluids, materials and energy related courses of the new 1st and 2nd year engineering curriculum which was approved during the winter



D.H. Norrie



R. Noreen



J. Holdsworth

Plate 6.4
The first
team

Plate 6.5
The first Mechanical Engineering administrative
team 1966-67

of 1965, in this task he cooperated closely with Dr. George W. Govier, chairman of the committee responsible for the design of this portion of the programme. Jim Venart also found time to start research during his first year at Calgary. Before the winter term of 1965 was out, he had constructed a fluid thermal conductivity cell for measurements on various fluids near their critical points and in a wide range of temperatures and pressures. In collaboration with George Govier, he began assembly of an apparatus for investigating the vertical flow of two-phase media. This study swung into *high gear* when Mr. Francis K.C. Yip, the first mechanical engineering graduate student at Calgary (see Plate 6.19) arrived in May, just a few weeks after Faculty Status for Engineering at Calgary had been achieved on April 1, 1965. Two weeks after Francis Yip's arrival, Alan Doige, who had completed his Ph.D. studies at Purdue, returned to resume his duties on May 18, 1965.

The first female engineering professorial appointee and the third mechanical engineering staff member in the new Faculty was Dr. Svetlana Winnikow (see Plate 2.39). She was appointed Asst. Prof. on Sept. 1, 1965, and arrived just in time to help launch the new 1st year engineering programme. Svetlana Winnikow and Jim Venart were involved in introducing the freshman course, Eng. 201, for which they wrote, in collaboration with their chemical engineering colleague Dr. K. Aziz, a laboratory manual on the *Behaviour of Gases and Liquids*, published by the University's Printing Services in Jan. 1966.

The Fall 1965 Session also saw the

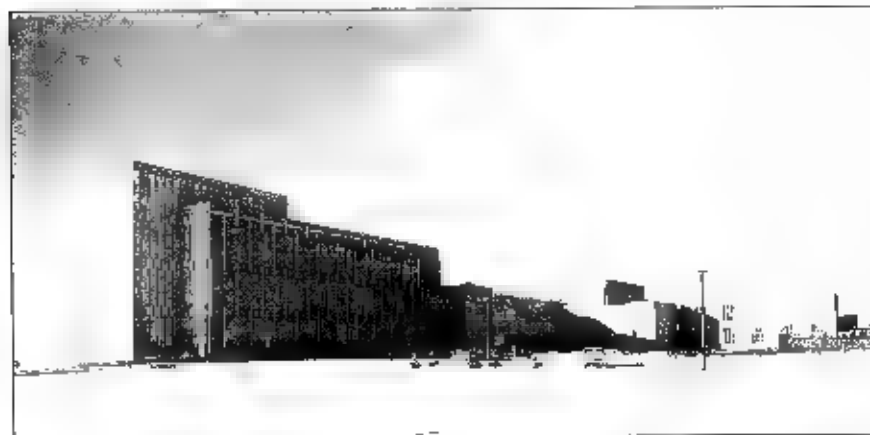


Plate 6.8 A view of the Engineering Building complex as it existed during the winter of 1966-67 with the E, D and C Blocks complete and B Block under construction as seen in the right central area of the picture. From window 111 of the 4th floor level, looking northeast, across the parking construction site enclosure, view towards the NW. (22 Jan. Feb. 1966)

Mechanical Engineering 1966-1976

introduction of an MSc programme in mechanical engineering. There were 5 full-time MSc students including Messrs W.G. Lancaster, V.V. Kappel, Ch. Krishnamurthy, F. K.C. Yip and K.R. Bansi, as well as a Diploma student, Mr D.E. Lauckner, registered in the Faculty with specialization in mechanical engineering (see Fig. 6.3). Note that this listing is according to date of admission, the month being Jan, March, April, April, June and August 1966, respectively. Each of the 3 staff members offered 2 graduate courses during 1965-66, one in each term, courses which had registrants from the other 21 full-time engineering graduate students and the 64 special students in the Faculty, the latter group comprising mostly local practicing engineers.

Mechanical engineering research activity was funded by grants in aid of research to the 3 academics from the National Research Council, NRC, and the Defence Research Board, DRB, amounting to \$17,300 for fiscal year 1965-66 (see Fig. 6.4). These funds supported studies on such topics as vibration of beams subjected to impact loads, vertical upward flow of air-water mixtures, thermal conductivity of fluids including blood, and convective heat transfer from non-isothermal surfaces.

The 3 mechanical engineers, as all staff members in the Faculty, were also heavily involved in curriculum design during 1965-66. It was during

that academic year that the 3rd and 4th year common core courses and the chemical, civil and mechanical engineering departmental courses of the new engineering programme were designed, finalized and approved.

The Department of Mechanical Engineering officially came into existence on July 1, 1966, as did the Departments of Chemical, Civil, and Electrical Engineering and Common Curriculum. Mechanical Engineering was one of only two units for which a Head had been appointed prior to that date. For the Department it was Dr. Douglas H. Norrie, Professor and Head of Mechanical Engineering, effective July 1, 1966 (see Plates 2, 49 and 6, 17). Doug Norrie arrived with his family from Australia on the weekend of July 17, 1966 after becoming a landed immigrant at the Pacific Highway border crossing on Friday, July 15. Some 10 weeks earlier, on May 1, 1966, Dr. Trevor K. Groves joined the Faculty as Assoc. Prof. of Mechanical Engineering, having completed his doctoral studies at McGill University. He brought with him several years of experience in studies of shock and explosion phenomena while being employed with DRB, specifically the Defence Research Establishment at Suffield. DRES. His appointment as well as that of Dr. M.A. Ward in Civil Engineering a few months earlier, who also came to Calgary from DRES, helped to establish the *Suffield Connection*, a period of close cooperation between Engineering at Calgary



Plate 6.19 MSc Candidate Francis K.C. Yip is shown with his vertical 2 phase flow apparatus (bubble generator, used in studying the upward flow of air-water mixtures). He was the Department's first MSc student and first PhD graduate.

and DRES which extended over several years. Access to valuable experimental research facilities for our early graduate students in Civil and Mechanical Engineering, exchange seminar lectures, field trips and site visits to Suffield by graduate and undergraduate student groups and research support were but a few of the benefits derived from this cooperation.

The new staff members, Drs. Groves and Norrie, joined their 3 mechanical engineering colleagues, being housed in the Civil Engineering Wing until August 1966 when the whole Department moved into its temporary quarters in the newly completed Chemical

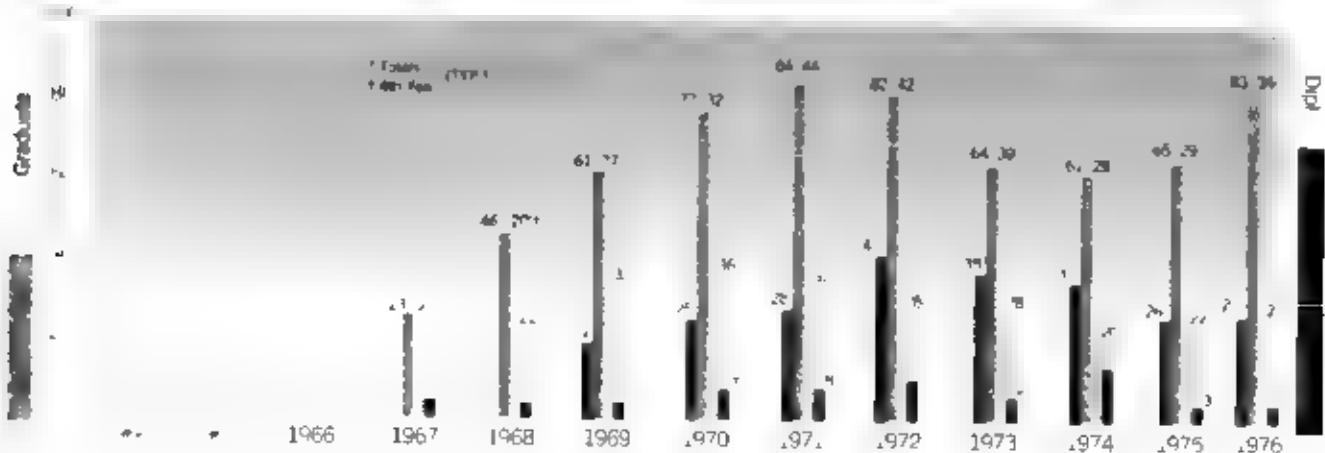


Fig. 6.3 Enrollment and Convocation Statistics for Mechanical Engineering 1964-1976

Engineering Wing (D-Block). Much of the move was organized by Miss Bonnie Noreen, the first Departmental Secretary in Mechanical Engineering, who had been hired on June 14, 1966 (see Plates 6-7 and 6-18). The Department's stay on the 2nd floor of D-Block was foreseen to be short lived since tenders for the Mechanical Engineering Wing (B-Block) and Energy Transfer Building were issued in July 1966. The new Engineering Wing was ready by the Fall of 1966 (see Plate 6-18).

The Fall 66 Session introduced the 2nd year of the new undergraduate curriculum. The five mechanical engineering staff were involved in 8 first and second year courses, 4 for each year. They also provided 6 graduate courses, including a new course on *Fields and Configurations* to the engineering graduate class of all students, whom 3 PhD and 6 MSc candidates and 1 Diploma and 1 certificate students were registered in Mechanical Engineering. Amongst these 12 registrars there were 3 new MSc students Messrs. B.G. Krishnappan, K.W. Lamiar and N.C. Saha as well as the Department's first PhD student Mr. A.K. Aston-Ekrem, who completed a MSc degree requirements in Mechanical Engineering in August and was admitted into a doctoral programme in Mechanical Engineering on September 1, 1966 (see Plate 6-12). Mr. Francis K.C. Yip, the first mechanical engineering graduate student at Calgary, finished and defended his MSc thesis in November 1966 to become

the Department's 2nd PhD student in January 1967 (see Plate 6-19). Mr. Vlastimir V. Kappe followed suit in May after completing a MSc degree requirements at the end of April (see Plate 6-17). A Spring Convocation on May 30, 1967, he and Francis Yip became the Department's first graduates with the first MSc degree in Mechanical Engineering at the University of Alberta.

The mechanical engineering department was also busy in the fall of 1966, with the completion of 7 academic years, including and acquiring a number of laboratories associated with courses in the 2nd year of our mechanical engineering curriculum and the implementation of a new curriculum in September 1967. At the same time, the lack of permanent facilities, research in the Department, was expanding rapidly with external funding exceeding \$100,000 during the 1966-67 academic year, including major equipment grants and the first support from industry (Imperial Oil Co.) (see Fig. 6-4). This rapid growth and regular input allowed us to begin in some sense by the Fall of 1967 Graduate Student granting the Department approval of the MSc and PhD



A. K. Aston-Ekrem



V. V. Kappe



F. K. C. Yip



N. C. Saha

Fig. 6-19. The first graduates of the Department of Mechanical Engineering, May 30, 1967.

programme in 3 broad areas: solid mechanics, fluid mechanics and thermodynamics. With such authorization, increased funding and new graduate students, ongoing research projects were expanded and studies initiated in the field of a response of plants and ships to transient and thrust loadings, the natural frequencies of shells of revolution, detonation in condensed explosives, blast wave propagation, vibration and performance of axial flow machines, transport of liquefied natural gas (LNG), thermal contact resistance, unsteady behaviour of flame waves and the propagation of liquid sprays.

The Department Head was naturally concentrating much of his time and energy on finding quality academic and support staff to succeed him in attracting Drs. Graham Waker and M. Srinivasan who joined the Department as Assoc. Prof. on July 1 and Sep. 1, 1967 respectively (see Plate 6-20). Seem Yeh was hired as reader in heat transfer for Svetlana Winkow who was hired effective Aug. 1, 1967. The Department's teaching staff was further reduced when Jim Vennart accepted the Asst. Dean's position on May 15 effective July 1, 1967.

The highlight of the Summer of 1967 for Mechanical Engineering, however, was the move in August into the new B-Block, the home of the Department for the following 24 years. Fortunately, a number of secretaries and technicians had come aboard during the spring and early summer who were helping with the move. The secretarial staff had grown from 1 to 3 with the hiring of Misses Bonnie Germain and Evelyn Carter on June 1 and July 18, respectively (see Plate 6-21). A start on building up the required technical staff for the department had also been made when Mr. R. J. R. and Mr. A. O. Michale joined the Department on April 1 and June 1,



Fig. 6-21. The secretarial staff in B-Block, Spring 1968.

1967 respectively. The former's tenure was rather short lived while Art Moehrie became one of the Department's most valuable and longest serving senior technical staff member (see Plate 6.27). During the move on August 21, 1967, Mr. John Hodsworth (see Plate 6.17) senior technical staff member in charge of the Explosives Section at DRES, arrived to become the first Technical Supervisor in Mechanical Engineering. He moved into Room B-03 which was to remain his office until his retirement in 1980.

Although not quite settled in its new home by start of the Fall '67 term, the staff was happy to greet the first mechanical engineering 3rd year class of 23 students in its own Wing. The students also enjoyed their Home Room and the new facilities. Graduate enrollment in Mechanical Engineering continued to expand with 6 PhD and 8 MSc candidates in course (see Fig. 6.3). The Department's first MEng candidate Mr. Herbert Tims, began his programme in September '67 and there were also 2 special students and a Diploma student registered in ME courses. Amongst the PhD and MSc students were such new arrivals as Messrs D.Q. Dang, N. Man (see Plate 6.28), V. Vasishtha, and B.R. Long, an engineer working at DRES who decided to do his PhD at Calgary using the facilities at Suffield to carry out the experimental portion of his programme. At fall convocation on Oct. 20, 1967, Mr. Chitkala Krishnamurthy became the 3rd MSc graduate from Mechanical Engineering at The U of C.

The academics in Mechanical Engineering continued to be involved in common core teaching during 1967-68, offering 1 first year, 3 second year and 2 third year courses. They also taught for the first time 6 courses in

the 3rd year departmental programme with associated laboratories. In addition they lectured in 6 graduate courses including 2 new offerings: Eng. 685 *Adv. Fluid Mech. II* and Eng. 687 *Cryogenics*. To help with this teaching load, the Department was able to attract 2 new staff members during the year appointing Mr. W. Ernst Eder as Assoc. Prof. and Dr. Joseph S.

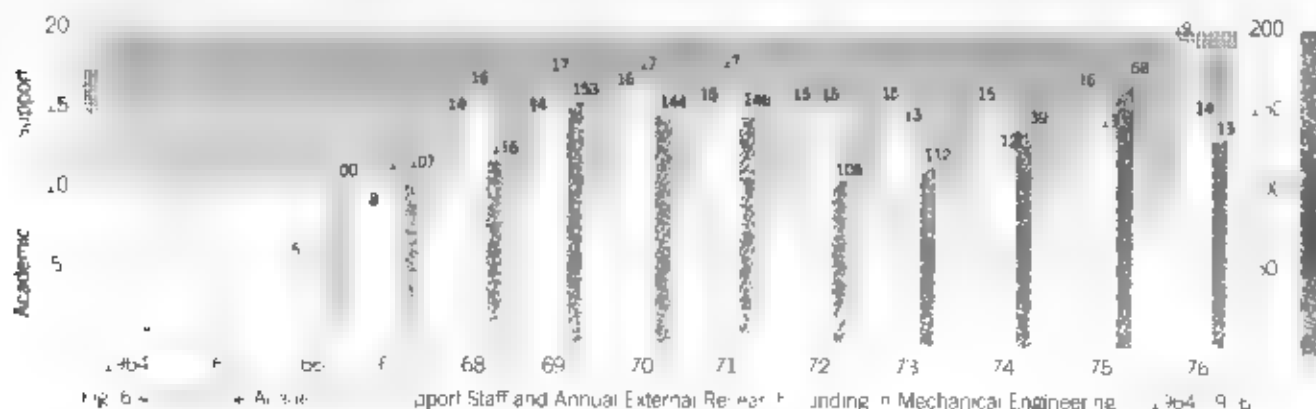
A. dekrasinski, as visiting Assoc. Prof. effective Jan. 1, 1968 (see Plate 6.20). Significant also was the contribution made by the full-time graduate students who served as Graduate Teaching Assistants, GTA's. For the first time, there was also a research associate in the Department, Dr. S. Mirza, who was working with Allan Doige on vibration of sandwich shells.

With such manpower resources, with new staff and graduate students and with increased external research funding (\$107,000, see Fig. 6.4), the scope of investigations naturally expanded to include new studies on such topics as critical heat pipes, flow and thermal characteristics of cryogenic jets, high pressure equation of state, Stirling cycle machines, fluctuating properties in turbulent flow with a free surface and creep strains in pressure vessels using a Moire Replica method. This growing research activity was acknowledged, in some sense, by the appointment of the



Plate 6.21: Mr. A. A. Akor Ekrem, the first PhD student in Mechanical Engineering at Calgary, studying the dynamic response of a steel shell to determine its natural frequencies and mode shapes, circa 1968-69.

Head Douglas Norrie, as Chairman of DRB's Advisory Committee on Engineering Research Grant Awards. Recognition of the Department's growing expertise was underlined also by various consulting, invited seminar and advisory activities of the staff. One such consulting project, involving Allan Doige and Trevor Groves, dealt with the topping of the *Northh, / Water tower* (see Plate 6.29). Concern about possible damage to underground service lines and neighbouring houses due to the expected shock of the impacting tower resulted in a number of precautionary measures. Firstly, several loads of large truck tires were hauled in and piled in the impact area. Also, seismographic equipment and 2 instrumentation specialists, including Mr. Ron Naylor, were brought in from DRES to monitor ground motion resulting from the shock. After days of preparation the tower was pulled down, rotating about 2 diametrically opposite supports which had been converted into non-





G. deVries

D.G. Huber

S.A. Karim

E.C. Mikulic

R.W. Page

D.V. Reddy

M.C. Singh

Plate 6 Further appointments of appointees - Mechanical Engineering 1968

ges, with the remaining 6 legs cut. Landing on the pile of trees the ground motion caused by the impacting tower, as indicated on the seismograph, was negligible. It was yet another project on which staff from Safford cooperated with our academics, underlining the link that existed between URETS and Engineering at Calgary. This contact was fostered through a seminar series coordinated by Trevor Groves with the help of Dr. Ross B. Harvey and Mr. John Watson of DRES. We note that the same tower was in the news some 14 months earlier, when it was the subject, once again, of a prank by our undergraduates (see Plate 6.29).

Academics and support staff recruitment continued to be a top priority for the Department. Fortunately, between Sept. 67 and April 68, Doug Norrie succeeded in hiring an additional secretary, Ms. Margaret Swenson (see Plate 6.21) and 9 technicians, namely Messrs. W.A. Anson, R.L. Beckford, S. Chinnai, R.W. Gristatson, C.A. Heffley, J. Kow, A. Platt, B.R. Sanders and N. Vogt. As can be seen from Table 6.4, six of these 9 appointees

were to become long serving staff members, 4 of them still working today (1991). Also, 4 members of this group, Messrs. Anson, Beckford, Heffley and Sanders, were former employees of DRES and 3 of them became technical supervisors (see Table 6.2). A further technician, Mr. E.W. Crews was hired from Safford in Dec. 1970. To appreciate fully the magnitude and significance of technical expertise and experience gained from Safford, we note that the first mechanical engineering technical supervisor, John Holdsworth, Messrs. Howard Johnson and Vincent J. Kraus also came from DRES and became technical supervisors in Civil and in Chemical Engineering respectively (see Chapters 5 and 11).

The Department Head was equally successful in attracting academic staff leading to the following appointments: Dr. G.A. Karim, Assoc. Prof. Drs. R.W. Page and M.C. Singh, Asst. Prof. effective July 1, and Drs. E.C. Mikulic, Asst. Prof. and D.V. Reddy, Assoc. Prof. starting Sept. 1, 1968 (see Plate 6.23). As a mechanical engineer, the Head of Common Cur-

riculum, Dr. D.G. Huber, was also appointed Prof. of Mechanical Engineering on a 1/4 time basis, effective July 24, 1968 (see Plate 6.23). In addition, Joseph deKrasinski's visiting status was changed to an initial term appointment as Assoc. Prof. effective Jan. 1, 1969.

There were also a number of research, visiting and seasonal appointees in Mechanical Engineering during 1968-69. Supported initially by a U. of C. Post-Doctoral Fellowship, Dr. S. Raju spent some 3 years collaborating with a number of staff members, including Drs. D.V. Reddy and M.C. Singh. Dr. S. Mirza continued to work with Prof. Doige during the summer of 69, while Dr. E.E. Gaster from Imperial College spent the Fall 68 term in Calgary as Visiting Prof. cooperating with Dr. Walker. Jim Ventart's work on free convection from non-isothermal surfaces, initiated with Svetlana Annkova, was furthered particularly in its analytical aspects, by Dr. W.T. Kierkus from the Technica Univ. of Warsaw who collaborated with him as PDF for 12 months starting Oct. 26, 1968 (see Plate 6.31). Finally, Dr. Gerard deVries, who completed the first 2 years of engineering in Calgary, 1961-63, joined Doug Norrie as Research Associate on Dec. 1, 1968, after completing his PhD at the U. of A. (see Plate 6.23). His return to Calgary was to be the start of a very productive period of collaboration for Drs. deVries and Norrie.

Three further MSc students completed the degree requirements in 1968 with Mr. K.R. Bansil graduating in the spring and Messrs. B.G. Krishnappan and N.C. Saha in the fall of 1968.

The final year of the new engineering curriculum was implemented in Sept. 1968. The first 4th year mechanical engineering class numbered 20 while the 3rd year enrolment stood at 26, including one female, Miss Barbara

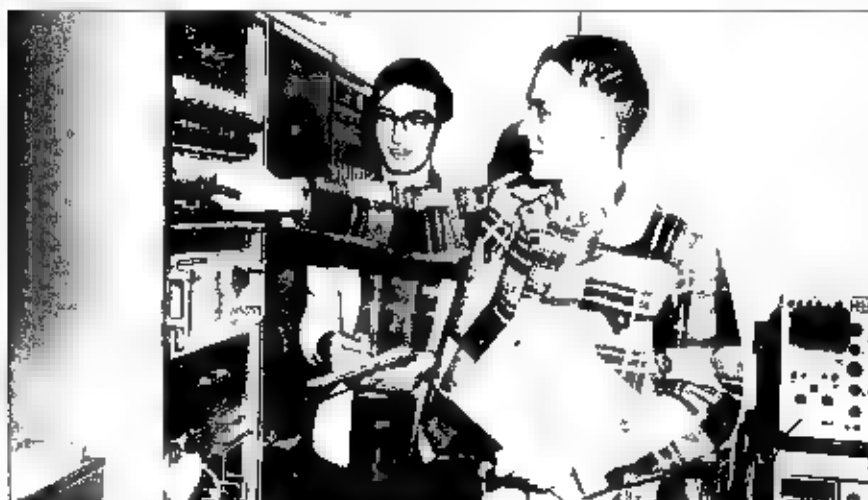


Plate 6.11 Ronald B. Hunt, R. and Harvey, F. Kowerson, 3rd year ME and E students, rescue during a field trip to the Safford mine. The trip was to the mine to investigate the cause of the explosion. The students were with the mine engineer, Mr. J. Kowerson, and the mine engineer, Mr. J. Kowerson, after the explosion. The students were with the mine engineer, Mr. J. Kowerson, and the mine engineer, Mr. J. Kowerson, after the explosion.

Jean Matthiesen, the first woman undergraduate in Mechanical Engineering. (see Plate 6.32)

Graduate enrollment increased again for a Fall 68 registration of 22 comprising 10 PhD, 10 MSc and 2 MEng candidates and including newcomers Messrs. D.M. Coulter, T.W. Dunlap, M.V. D'Souza, A.M. Khalil, S.J. Khanna, J. Kucera, K.S.V. Kumar, K. Muka, D.G.S. Mohindra and W.F.P. Tsang. Eight graduate courses were offered to this large group of students, 6 of which were new. The staff also taught for the first time the full 3rd and 4th year departmental programme in addition to being responsible for 8 common core courses in the spring of 1969. 3 extension courses were offered dealing with Stirling engines, LNG fundamentals and air pollution.

Despite the heavy teaching schedule research activity flourished with external funding exceeding \$116,000 (see Fig. 6.4) including a 2 year \$38,900 grant from the UK Ministry of Technology to Joe Walker for research on miniature cryogenic cooling engines. Trevor Groves succeeded in securing the support of Canadian Industries Ltd. (C.I.) allowing the establishment of *The U of C Explosives and High Pressure Research Laboratory* (see Plates 2.64 and 6.33). He also spearheaded the design and construction of a shock tube facility (see Plate 6.35). With research projects and students let a *Imperia College* Ghaz Karim was busy in establishing a combustion research group in the

Department while at the same time trying to complete the projects in London. During his first year in Calgary he and his 4 students built an apparatus for flame research in stratified media a rig for flame stabilization and a device for measuring pulsating flow. He also initiated research on education kinetics in combustion and a pollution problems on combustion of partial oxidized products of natural gas on the utilization of natural gas and liquefied natural gas (LNG) as fuel in internal combustion (IC) engines, on pulsating flow and flame instability phenomena and on ignition and quenching problems in reacting premixed fuel-air charges (see Plates 6.34 and 6.44).

The Department's research facilities in the area of aerodynamics were established, a more single handedly and with practically no appropriate resources by Dr. Joseph S. deKrajsnski who began designing wind tunnels for the Faculty soon after he arrived in Calgary in January 1968. His first of several projects was the design and

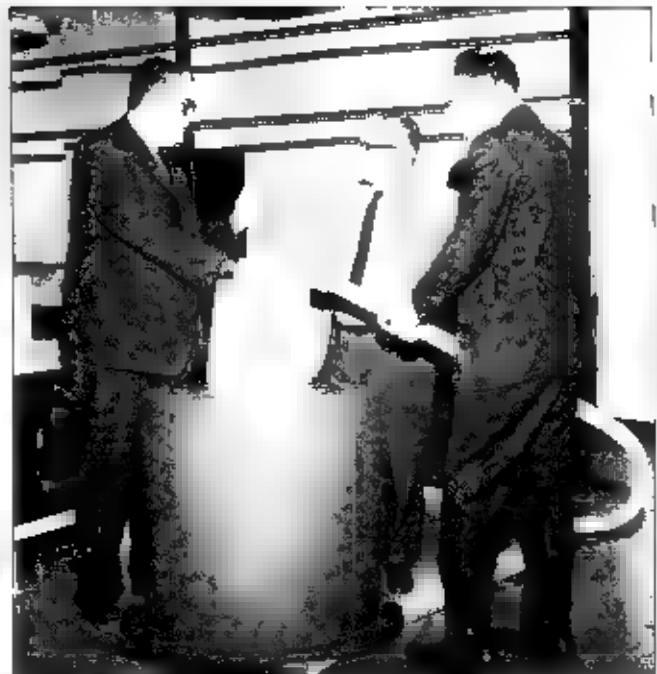


Plate 6.33 Dr. Trevor Groves, Messrs. Jean Matthiesen and Joseph S. deKrajsnski working on a shock tube facility. Dr. Groves was the principal investigator of the project. The shock tube was used for research on combustion phenomena. The project was funded by the U.S. Air Force Office of Scientific Research.

construction of a low speed air flow wind tunnel completed in 1969/70 (see Plates 6.37 and 6.38). Data monitoring and gathering was vastly improved by the assembly of the *Mechanical Engineering Data Acquisition System (MEDAS)* built in 1968/69 and based on the HP 2115A computer. Drs. Norrie Groves and Doige and Messrs. Anson and Sanders were key players in obtaining and installing this state of the art experimental facility.

A highlight for the staff was the first *Mechanical Engineering Industry Seminar* held on May 14, 1969. The seminar was very well received with 43 delegates from industry participating. Its success prompted the Dean to embrace the idea and expand its scope to include the entire Faculty. The next seminar, again a resounding success, was held on May 27, 1970 at which 67 senior representatives of industry from Southern Alberta spent a day in a dialogue with some 20 faculty on the short and long-term goals of engineering education and the curriculum features appropriate for attaining such education. Jim Venart was one of the keynote speakers and Ernst Eder edited the proceedings of the seminar. These annual meetings referred to as *Faculty Industry Seminars*

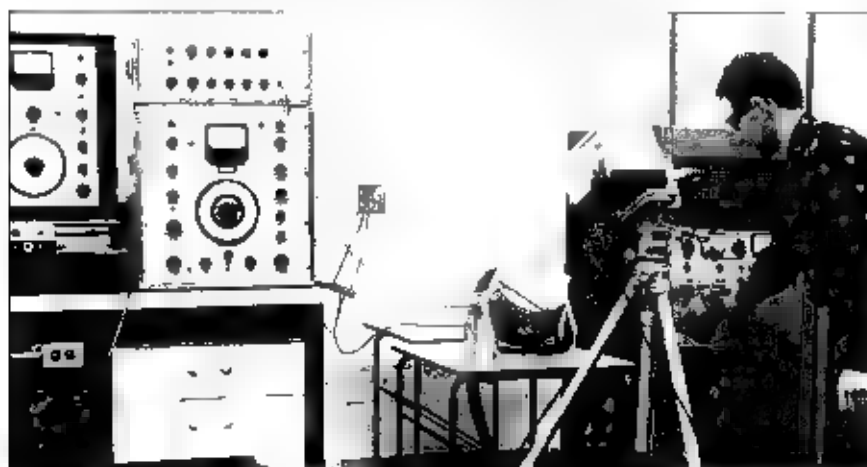


Plate 6.35 Mr. Joseph S. deKrajsnski working on a shock tube facility. The shock tube was used for research on combustion phenomena. The project was funded by the U.S. Air Force Office of Scientific Research.

years continued till 1974 and tried on such timely themes as *The Faculty Engineering Team Approach* the year of the Spring 74 election (see Table 6.2).

The main event in 1968-69 and demonstration for the Department and the Faculty however was convocation day on May 26, 1969, when 18 members of the first graduating class from Mechanical Engineering received their Bachelors. Dr. R.A. Rame at the podium announced that the first A division (see Table 6.2). One of these 18 first-year men, Mr. Harold R. Thompson, graduated with distinction and was selected as first recipient of the Association of Professors of Engineering of A++ A++ A++ Medal in the field of engineering & Technology for his merit.

The 1969 Convocation year began with a new staff members in Mechanical Engineering. After being in the Department as Research Associate for 7 months, Dr. Gerard deVries was given an initial term appointment as Asst. Prof. effective July 1, 1969 (see Plate 6.2). Two weeks later, Mr. Allan A. Torvi arrived to take up his position as Asst. Prof. starting July 14th (see Plate 6.31). These appointments compensated in part for the resignation and departure of Drs. M.S. Yeh and D.V. Reddy on June 1,

and Aug. 31, 1969 respectively.

There were a few new research and sessional appointees active in the Department during 1969-70. The Head hired 2 Ph.D.s, Drs. J.P. Shrivastava and P. Parthasarathy. The former is having completed his M.A. Thesis on Tayssol 3 degree sequence in the Department.

Experiments at The Ohio State Univ. to study the increase brought in E.C. Reardon as Research Associate starting in 1970 (see Plate 6.32). Gordon Beattie, a Ph.D. student in gas dynamics at the Univ. of A and stayed until the Fall of 1971. Dr. S. Das, introduced in the Department for a sabbatical and Dr. W.P. Lewis arrived to spend his leave as visiting Assoc. Prof. in Mechanical Engineering.

There were some changes in support staff as well. Three out of the 4 first secretaries, Mmes. Carter, German and Swenson, resigned between Sept. 68 and April 69, leading ultimately to the hiring of such long-serving staff

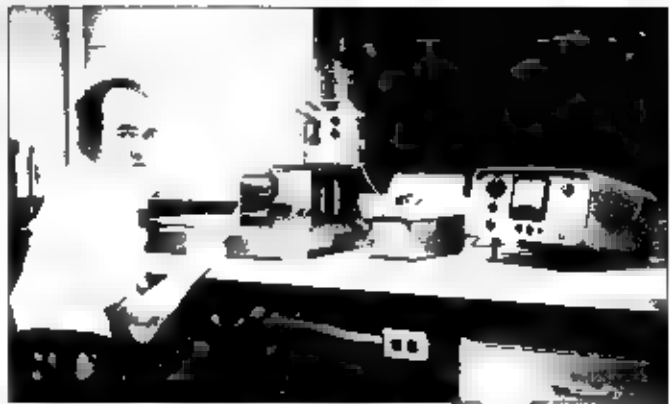


Plate 6.31: Mr. A. A. Torvi, Asst. Prof. in Mechanical Engineering, in his laboratory.

members as Arnela High, Ruth H. E. Betty Ann Maylor and Sheila Watson (McLay, two of whom became departmental secretaries (see Table 6.2). The departure of Messrs. Chinniah, Kok, Platt and Thomas allowed the Head to bring in new secretaries, as R. Crews, Joe Harker and Con Waterhouse (see Table 6.4).

The Department's continuing rapid growth was indicated by the very substantial increase in undergraduate and graduate enrollments. For Mechanical Engineering, the Fall '69 session started with 61 undergraduates, 34 and 27 in 3rd and 4th year respectively (see Fig. 6.3). Graduate student numbers increased by 50% from 22 to 33, comprising 13 PhD, 15 MSc and 5 MEng candidates and including such new recruits as Messrs. B. D. Agt, A. A. R. Bhattacharyya, S. R. Brahman, A. Khosla, V. Latinovic, A. K. Mishra, R. Seshadr, H. Seyed Aschraf and W. K. Wan.

To round out the Department's eventful year full of *firsts*, the Fall convocation on Oct. 17, 1969 saw Mr. Francis K-C Yip, the first graduate student and one of the 2 first MSc graduates in Mechanical Engineering, become the Department's first PhD degree recipient (see Plate 6.19). At the same convocation, Mr. D.E. Lauckner became the first Diploma graduate specializing in mechanical engineering and the third such degree recipient in the Faculty.

After one full academic cycle of the departmental programme it was decided to *fine-tune* some of the course sequencing, interchanging courses between fall and winter terms and mov-

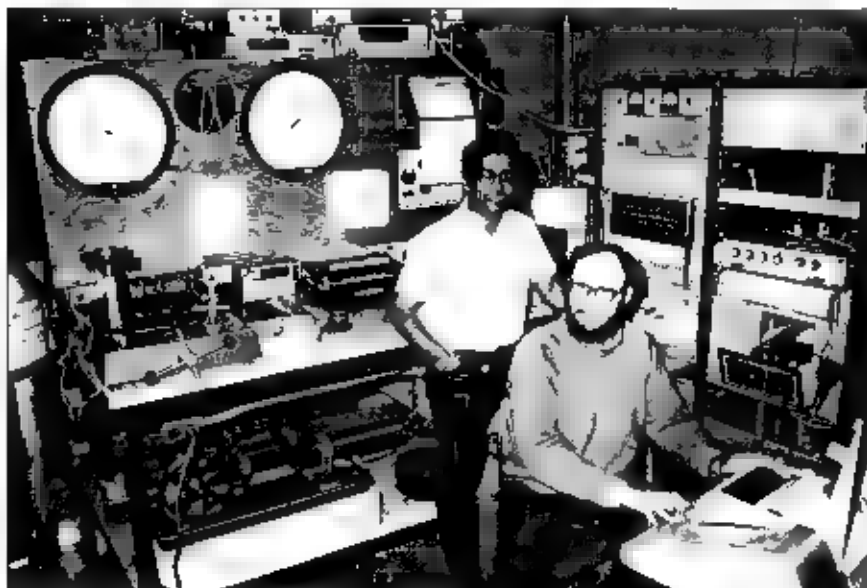
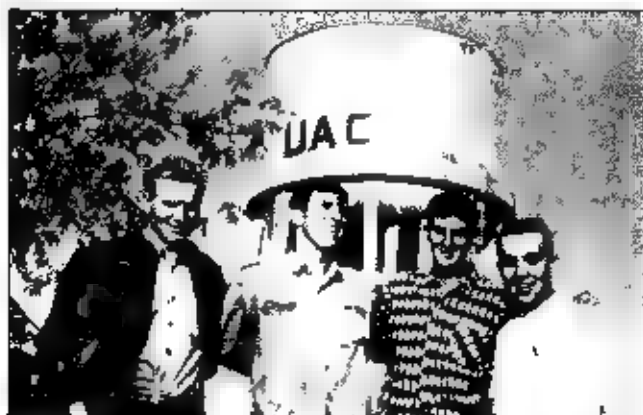


Plate 6.32: Dr. J. P. Shrivastava, Asst. Prof. in Mechanical Engineering, in his laboratory.



a The four **entrepreneurs** after completion of their year 4 work. A. Hoar BSc 69 EE, R.A. Hoar BSc 68, M.L. and A.J.C. Bancroft BSc 70 & MSc 77 EE and PhD 75 EE, Brian Young BSc 69 & MSc 70 Sept 29, 1965

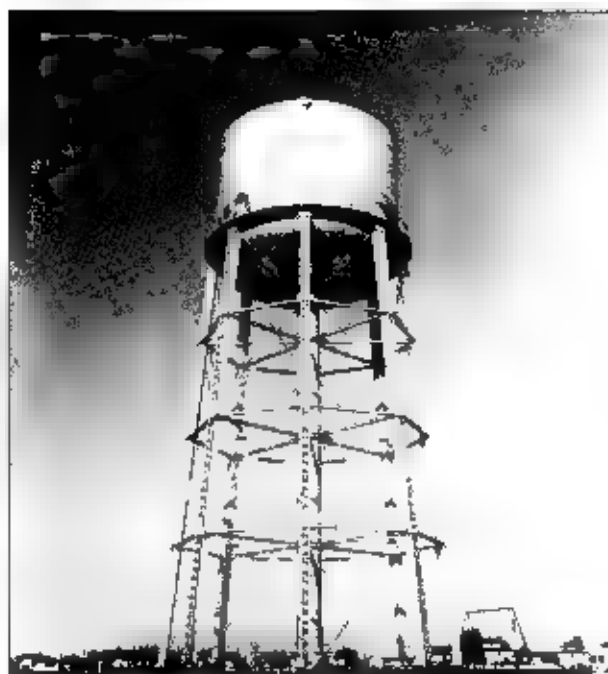


b The quartet on the catwalk high above the school yard leaving their imprint on the tank. Alan Hoar, bottom, John Bancroft, Ken and Jim Loose. Wednesday, Sept. 29, 1965

ing courses from 4th to 3rd year and vice versa. This process continued for 2-3 years until an optimum programme layout was achieved. A system of electives in the 4th year curriculum, primarily the 2nd term, was introduced in 1971-72.

With an increase in graduate students and research personnel and with external funding exceeding \$150,000 (see Fig. 6.4), the number of research projects grew accordingly. Doug Norrie, with a team of 3 PhD's and a research associate, and in collaboration with Gerry deVries, expanded his studies on finite elements and their use in the solution of field problems including fluid mechanics and thermodynamics topics. Ghaz Karim spearheaded the installation of a cryogenic fuel research CFR, variable

compression ratio engine with facility to simulate very low ambient temperature operation as well as a diesel engine test plant for studies on the use of automotive fuels. In addition, he offered one of the 6 new graduate courses introduced in 1969-70. *Combustion, Flames and Explosives*, organized an Air Pollution Seminar in Feb. 1970 and lectured in the extension course on Air Pollution, held in Banff, May 4-8, 1970. Joe Walker continued his work on cryogenic cooling engines supported by the Ministry of



c The Northhill water tower as it existed in the King George School yard prior to this paint job which covered previous artwork, like the one visible and created by electrical engineering students of the Class of '64. The 15.7 ft high 8-legged tower with a 500 X 30 gallon 2.3 million litres capacity tank was designed and built by Dominion Bridge Co. Ltd. in 1932 as part of the City of Calgary's Glenmore Dam water works development project.

Plate 6.29 — During Fresh Week in the Fall '65 term, two engineering freshmen, Jim and Ken Loose joined forces with two engineering sophomores, Alan Hoar and John Bancroft to paint the Northhill water tower located in the King George School yard at 10th St. and 20th Ave. N.W., Calgary. They managed to get inside the fence surrounding the base of the structure, climb the tower up to the catwalk and painted an 8 ft. high silver band around the tank and the inscription UAC in large bold letters and Engineers in smaller print. The tower was taken down on Saturday, Dec. 10, 1966 with Rainbow Salvage Co. Ltd. being the general contractor and W.C. Wermuth Holdings Ltd. the subcontractor for the demolition.



Plate 6.30 — Mr. R. Berthold in the departmental machine shop is using the Bridgeport milling machine to fabricating research equipment in 1970-71.



C.P. Bell



E.W. Johnson



A.A. Kentfield



W.T. McKis



J.P. Shrivastava



A.A. Tarn



P. Vermeulen

Figure 6.3 The first Head's findings at the department, 1969-70

Technology JK and DRB in the amount of over \$50 000 during 1968-70. His studies on Stirling cycle machines was funded by a \$28 000 grant from the Atomic Energy of Canada Ltd. (AEC). In addition he taught his undergraduate courses, offered a new graduate course, Engg 686, *Energy Conversion*, and was heavily involved in extension course and seminar activities. For example, he gave invited lectures on *Stirling Engines* at the Cummins Research Centre, Columbus, Ohio and at the University of Ohio, Athens, Ohio in Oct. 69 and on *Gas Turbine Power System Developments* at AEC, Ottawa, May 70. He also organized a 2 week course in LNG Technology for the Institute of Gas Technology, Chicago, Sept/Oct 1970. Jim Venart continued his investigations on thermal conductivity of fluids, on thermal contact resistance and on free convection. His funding from NRC and DRB was augmented

by an initial grant from AECL for work on heat pipes which helped to establish contact and led to a major contract a few months later.

The Spring 70 convocation on May 26th was another major event for Mechanical Engineering. The Department was happy for the 24 degree recipients from its 2nd senior class and was proud to see 4 of them graduate with distinction, the highest number of such graduates from any department that year. One of these 4 honours students was Miss Barbara J. Matheson, the first woman BSc graduate in Engineering at The U of C (see Plate 6.32). A second one, Mr. Brian C. Howes, was selected as the 2nd APEA and Merit winner in Mechanical Engineering (see Plate 6.38). Brian registered in an MSc programme thereby becoming the 1st BSc graduate from the Department to enter graduate work here. He ob-

tained his MSc degree in the Fall of 1972.

Equally significant for the Department was the size of the mechanical engineering graduating class in comparison with the total number of BSc graduates from Engineering. The 24 graduates from the Department represented 34.3% of the 70 engineering degree recipients at that May convocation. Taking into account the Fall

1970 graduates, this ratio still was 24.6% i.e. 32.9%. These statistics indicated the start of a trend in which Mechanical Engineering consistently graduated more than 25% of the total engineering graduating class. Thus for example, in 1972, 41 out of 104 i.e. 39.4% engineering BSc degree recipients were mechanical engineers. By 1980, the year before surveying engineering graduates came on stream, Mechanical Engineering had provided 31.3% of all engineering BSc degree recipients, thereby underlining the Department's *advantage* over its sister units in terms of attracting undergraduates, an edge referred to here as the *mechanical advantage*.



Portrait of Miss Barbara J. Matheson, the first woman BSc graduate in the Faculty of Engineering at The U of C.



Plate 6.4 A view of the tuned ring chamber with Mr. John Howes with a few others. The picture was sent to the graduates by Mrs. Pres. de Rea. Unfortunately, it was a bit blurry and the picture was not very clear. The picture was sent to the graduates by Mrs. Pres. de Rea. Unfortunately, it was a bit blurry and the picture was not very clear. The picture was sent to the graduates by Mrs. Pres. de Rea. Unfortunately, it was a bit blurry and the picture was not very clear.

On July 1, 1970, Doug Norrie went on a 1 year sabbatical leave to the University of Cambridge and Allan Dorge became Acting Head. Jim Venart's tenure as Asst. Dean expired on June 30, 1970 and he also left for a sabbatical year at the University of Sussex. Fortunately, the Head had attracted 3 academics, Drs. Peter J. Vermeulen, John A.C. Kentfield and Eric W. Johnson, all of whom were appointed Assoc. Prof. effective July 1. August 1 and Sept. 14, 1970, respectively (see

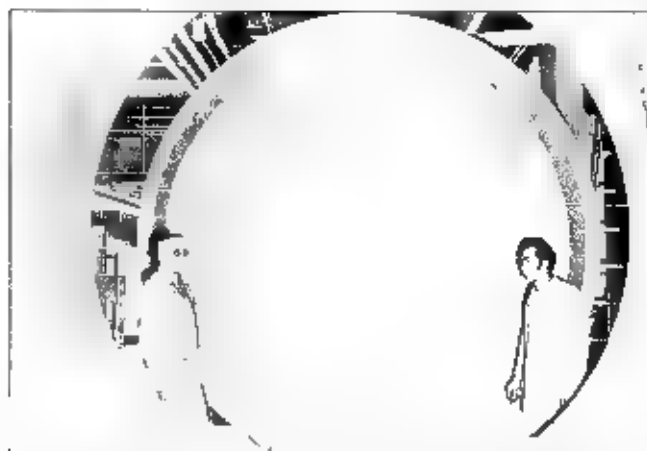
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Problems with budgets and staff reductions were forgotten, at least for

As opposed to the negative effects of the budget cuts, it was encouraging to see continued high level of research and graduate study activity in the Department. For example, there was the above noted AECU contract which Drs. Venart and Mani completed in the spring of 1972. Joseph deKrasinski was expanding his environmental aerodynamics studies with the completion of the boundary layer/environmental wind tunnel (see Plates 37 and 639). Ghaz Karim continued to build facilities for combustion research, completing his term as Acting Head, completing the installation of



This growing graduate study and research programme was supported by external grants and contracts totalling \$1,46,000 (see Fig. 6.4) and by 8 graduate courses, one of which was new. The staff was also involved in 3 extension courses, one of which was a 3 day seminar on *Production Operations Management*, the first



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extends on course on management related topics offered by engineering staff at The U of C. It was held at the Banff School of Fine Arts, June 1-3, 1972 with Profs. Alan Torvi and Errol Ede sharing the lecturing load of them having attended a 3 week course on the subject at the University of Western Ontario in June 1970 and June 1971 respectively. The seminar was very well received so that it was repeated Dec. 6-8 1972 Dec. 10-12 1974 Feb. 18-20 1976 and Apr. 13-15 1977. It also spawned other continuing education activities, including a 2 day course on *Management for Engineers* presented in Jan and in April 1975 in which Allan Torvi shared the lecturing with Dr. M.B. Lee and Mr. C. Longman. A series of short courses on critical path methods (CPM) by Allan Torvi between 1979 and 1984 will be reviewed in Appendix H.

Another positive influence on the Department was the appointment of a Head after 2 years of operation with Acting Heads. Returning from his leave, Dr Allan G. Doige stepped into the Chair to become the Department's second Head from 1 Sept. 1972 to 30 Sept. 1976 (see Plate 6.42). Declining graduate student numbers and cutbacks in GTA and sessional funds combined with under-graduate enrollments continuing practically unchanged (see Fig. 6.3) led to



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M. S. Fournier et al.


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the new Head's first set of problems, teaching a new course. These difficulties were compounded by previously approved sabbatical leaves for 3 staff members and by the appointment of Alan Torvis as Acting Head of Curriculum for a year, starting July 1, 1972.

The Fall convocation on Nov. 10, 1972 provided an uplift for the Department with the graduation of 4 PhD and 4 MSc candidates, hereby also establishing a new mechanical engineering record for total number of graduate degree recipients at a convocation and in a year. Instead of returning to the Department on a full time basis at the end of his term as Acting Head Prof. Torvi accepted the Assistant Dean's position for the period July 1, 1973 to June 30, 1975. Manpower became an issue of some urgency when Dr. E. S. Venart re-

signed and left the University of New Brunswick on August 31, 1973. The Departure of Armstrong, one of the 6 founding members of the Faculty, was a serious loss to the Department. Fortunately, Dr. A.K. Astor, Ekrem, the Department's first PhD student, was interested in returning to Calgary and was appointed Asst. Prof. for a limited term, September 1, 1973. June 30, 1976 (see Plate 6.42). Another term appointment was impossible due to the newly imposed 80/20 Rule and a grant application submitted during those times of financial constraints.

The next change in academic affairs occurred in Nov. 1, 1974 when Doug Norre returned to the Department on a full time basis after the Division of Information Services was discontinued. Less than 2 months later on Dec. 24 Grant Huber, Acting Dean



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after But Ritters departure resigned and left for New Zealand where he had spent a sabbatical year in 1972-73. When Eric Johnson was selected to be Allan Tivins successor as Assistant Dean on July 1, 1975, a position renamed Associate Dean Student Affairs. 2 months later the new Dean supported Allan Doige's request for a replacement. Dr. Gerald E. Smith, a U of C alumnus, was appointed Asst. Professor, a year limited term starting Sept. 1, 1975. Gerry Smith had taken the first 2 years of engineering at Calgary 1961-65, before graduating with distinction in 1967 from Mechanical Engineering at the U of Alberta and a PhD in 1970 at Nottingham.

Allan Doige also made a contribution in visiting research and sessional appointments during his term of office. For example, Dr. V. Ramesh joined the Department in October 1974 to work with Dr. J.S. Desai as a PDF (see Page 642). Dr. Ramesh was to become a long serving sessional staff member in the Faculty of the Department (see Table 64). A research appointee was Dr. G.S. Bar, who arrived in Oct. 15, 1975, to work with Dr. M.C. Sengupta to serve in Mechanical and Chemical Engineering as sessional instructor for a number of years, starting Sept. 1976. Dr. Jon J. Drifly came to Chemical Engineering as research associate

during the summer of 1974. He was appointed Sessional Instructor for the Fall 75 term to teach ENME 568 - Control Systems, while Ed McKinnon was on sabbatical leave at Sherbrooke (see Page 643). Visitors in the Department included Dr. R. Peter and Philip Bets, Dr. Fergus, Deputy Director of the Fluids Institute in Montreal and Enegetics in Warsaw, was hosted by Prof. Karim during his stay in January 1976. Philip Bets, who is now at the University of Manchester in Calgary, working with Drs. Desai and Norrie on the application of aerodynamic techniques to free surface flow problems, and serving as a sessional instructor at U Dec. 31, 1976.

Another of the Department's PhD graduates was a research associate and/or sessional instructor after completing their degree requirements. For example, Dr. A.K. Mishra, PhD '74, followed a sessional appointment during 1974-75 (see Page 642). One of the early students in Mechanical Engineering, Dac Q. Dang, also obtained his doctorate at the Faculty of Architecture and continued in the Department as PDF, part time research associate and/or ses-



Fig. 6.3: A portrait of a faculty member, likely a sessional instructor or research associate, sitting at a desk with papers and a lamp.

sional instructor in 1974 (see Page 642). While mentioning graduate degree recipients, one might note the first MEng graduates from Mechanical Engineering, Messrs K.S.V. Kumar and Herbert Tims, at the spring and fall convocations in 1973, respectively (see Page 643).

The Department's staff at university funded support staff decreased by 15 in 1973, including 10 technicians and 3 secretaries (see Fig. 6.4). One additional secretary was supported from external research funds. A noteworthy

change in support staff was the resignation of Stephanie Howard on May 10, 1974 and the appointment of Mrs. Ruth Hittle as the new Departmental Secretary effective June 1, 1974 (see Tables 62 and 64).

A quick examination of Fig. 6.3 reveals the substantial decrease in undergraduate enrolments after 1972. The decrease in total student number from 82 to 64 was due primarily to the drop in the Fall '71 3rd



The Champs: Left: R. S. N. J. de la Haye, MA, BSc, HAN, 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th, 101st, 102nd, 103rd, 104th, 105th, 106th, 107th, 108th, 109th, 110th, 111th, 112th, 113th, 114th, 115th, 116th, 117th, 118th, 119th, 120th, 121st, 122nd, 123rd, 124th, 125th, 126th, 127th, 128th, 129th, 130th, 131st, 132nd, 133rd, 134th, 135th, 136th, 137th, 138th, 139th, 140th, 141st, 142nd, 143rd, 144th, 145th, 146th, 147th, 148th, 149th, 150th, 151st, 152nd, 153rd, 154th, 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A.C. Dodge F.S. Howard J.J. Duffy A.K.A. Elkrem A.K. Mishra V. Ramesh G.E. Smith

Plate 6.42 The second Head with the Departmental Secretary and some of his appointees 1974-75

year enrolment. The trend reversed itself a year later and by the fall of 1976 the number of juniors and the total enrolment had bounced back to previous record levels. Recovery in senior year registrations was slightly slower. Naturally the number of BSc graduands showed a similar trend with the turnaround year of 1974 posting only 20 degree recipients, a record low for the Department next to the inaugural year's 19 graduands. Graduate student numbers began their slide in 1971 and by 1974 had dropped to 20, only slightly more than half the peak enrolment of 36 in 1970 (see Fig. 6.3). The growth curve for graduate enrolment after 1974 was relatively flat showing an increase of only 3 students, i.e. 15%, by 1976. The number of graduate degree recipients also dropped during those years and reached pre-1970 levels by 1975. An exception was the year 1974 when 7 PhD and 6 MSc graduands from Mechanical Engineering received their degrees thereby establishing several all-time departmental records including maximum number of PhD graduands in a year (7) and at a single convocation (5) and largest number of graduate degree recipients

in a year (13).

In addition to the details described above and indicated in the photographs and captions thereto, the following additional departmental and staff highlights are briefly reviewed:

- Prof. Allan A. Torv was selected winner of the *Outstanding Young Faculty Award* presented by the Pacific North West Section of the American Society for Engineering Education (PNWS-ASEE) at its annual meeting in Banff, May 14-15, 1971.
- Dr. G.A. Karm was awarded the DSc by the University of London dated Aug. 31, 1972 and formally presented at convocation in 1973.
- Dr. D.H. Norrie was President of The University of Calgary Faculty Association, TUCFA, during 1969-70.
- In December 1969 Dr. G. Walker completed the painting of portraits of the first Dean of Engineering, Dr. A.M. Neville and the first Chancellor of The U of C, the Honourable C.C. McLaughlin, oil paintings which have been on display in the Central Foyer of the Engineering Complex since then.

- Dr. Eric W. Johnson was awarded a \$7,500 major equipment grant by NRC in 1971 which paid for a Zeiss stereoscopic plotter and helped to equip the Department's Photoelasticity Laboratory (see Plate 6.57).

- Some of the first signs of international recognition

of the research on finite element techniques and their use in field problems carried out by Drs. G. Devries and D.H. Norrie included an invitation for the duo to present a lecture series on *Application of Finite Element Methods in Fluid Dynamics* at the von Karman Institute for Fluid Dynamics, Brussels, Belgium, March 1971.

- Soon after his arrival in Calgary Dr. Peter J. Vermeulen began research on acoustic flame interactions and became active in the Mayor of Calgary's Pollution Study Committee dealing amongst other issues with noise pollution. A second staff member interested in acoustics and vibrations was Dr. A.G. Dodge who brought back rich experience from his 1971-72 sabbatical leave at Southampton University's Institute of Sound and Vibration Research (SVR). The two academics cooperated in offering a short course on *Noise and the Urban Environment* Jan. 10-11, 1974 organized by Peter Vermeulen and also involving Dr. Hugh W. Jones from Physics who was appointed Adjunct Prof. of Mechanical Engineering in 1977. Joining forces, Drs. Jones and Vermeulen spearheaded the formation of The U of C Acoustics Group and succeeded in obtaining major funding (\$42,200 from the Province of Alberta for the



Plate 6.43 Adjunct Prof. Mr. Herbert Tims, MEng student in Mechanical Engineering in Sept. 67. Mr. Herbert Tims took civil engineering graduate courses starting in the Fall of 1964. In 1967 he attended the ME course and in the Fall of 1968 session registered in 3 ME courses. He was one of the first two MEng students from Mechanical Engineering in 1973.

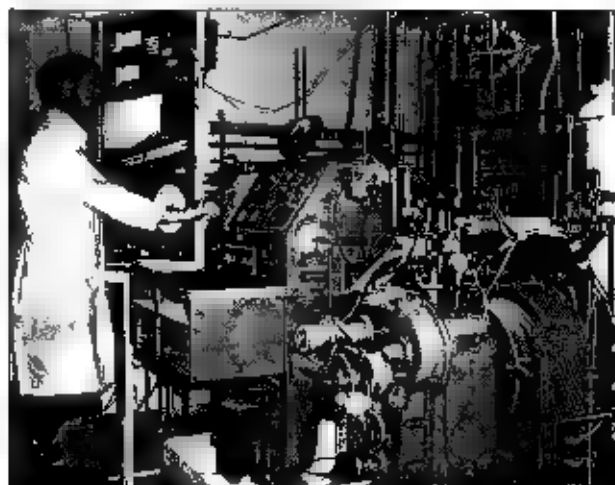


Plate 6.44 Mr. Reg Gustafson, research assistant, working on the development of a gas turbine engine for studies on the use of methane and liquefied natural gas as fuels 1970-71

- $$r = \frac{1}{2} \left(\frac{1}{\rho_1} + \frac{1}{\rho_2} \right) \quad \text{and} \quad \frac{1}{\rho_1} = \frac{1}{\rho_2} = \frac{1}{\rho} \quad \text{if} \quad \rho_1 = \rho_2 = \rho$$

He developed a 3 volume programme, *Metrication and Survival in the Oil and Gas Industry*. A leading Programme in Scientific and Technical Publications published in May 1986. The Learning Programme was so popular it was revised with a new edition put speedily into print. Karm continued to be consultant on metrication and gave practical workshops for the Canadian Association of Petroleum Engineers, the Petroleum Engineering Society of Petroleum Co. Ltd., Brascan Petroleum Co. Ltd. and the City of Calgary. Other mentions but a few.

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- As Program Chairman and Chairman of the Steering Committee for the Engineering Institute of Canada's *Petrochemicals West Conference* Prof. A.A. Torv was responsible for the organization of this meeting, held in Calgary, May 11-13, 1976.

- From the time he joined the Faculty in 1968, Dr. Edwin C. Mikulick continued his research on the dynamics of articulated vehicles, work which tied in with his interest in control systems and was an extension of his doctoral studies at Cornell University. His paper on "acknowledging of tractor semi-trailer units," presented at and published in the proceedings of the Society of Automotive Engineers Congress in Detroit, Jan. 11, 1971 brought his work and expertise to the attention of U.S. firms. Consequently he was called in to consult on vehicle dynamics for The Mather Co., Toledo, Ohio, and the Illinois Inst. of Technology Research Institute, IITR, Chicago, Illinois. He also had an excellent graduate student, Mr. S.R. Brahmin join him in September, 1969, who carried out a study on an idea conceived by Ed Mikulick during the last few months of his



Dr. Edwin C. Mikulick (left) with his research staff. From left to right: Dr. J.A.C. Kent, Dr. J. Higgins, Faculty Stores, Dr. J. W. (Reg.) G.

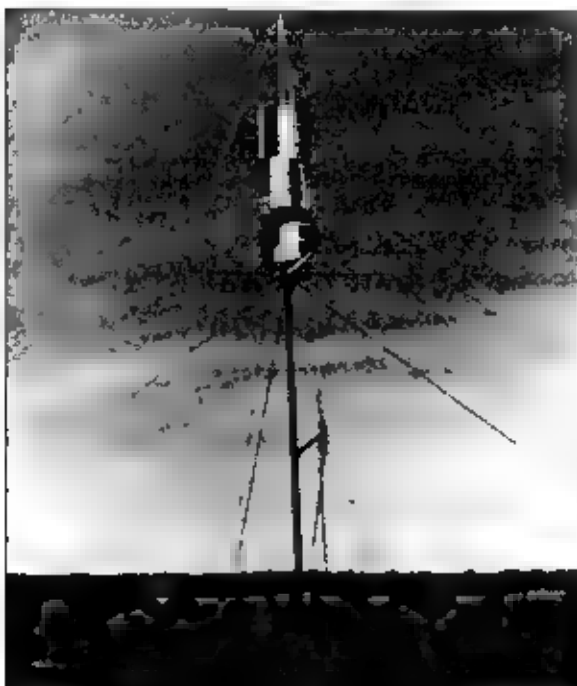
PhD studies (see Plate 6.40)

A visit to the Ministry of Transport in Ottawa during the early 1970's established contact with its various departments and agencies, including the Transportation Development Agency (TDA) in Montreal. This contact resulted in grants, totalling \$15,000 between 1973 and

1975 for research on the stability and hitch loads of highway vehicle combinations. Dr. Mikulick was consultant to TDA and IITR (1973-76) to Auto Steering Trailers Ltd. in Oakville, Ont. (1976-77) and to the Ontario Dept. of Transportation and Communication, the latter being involved in an experimental project on tractor trailer anti-acknowledging devices, carried out for TDA in 1975-77. He was called to give expert testimony before the Ontario Legislative Assembly's Committee on Highway Safety in 1976-77 on articulated vehicles. Subsequently he studied and carried out experiments on the effects of highway surface roughness and

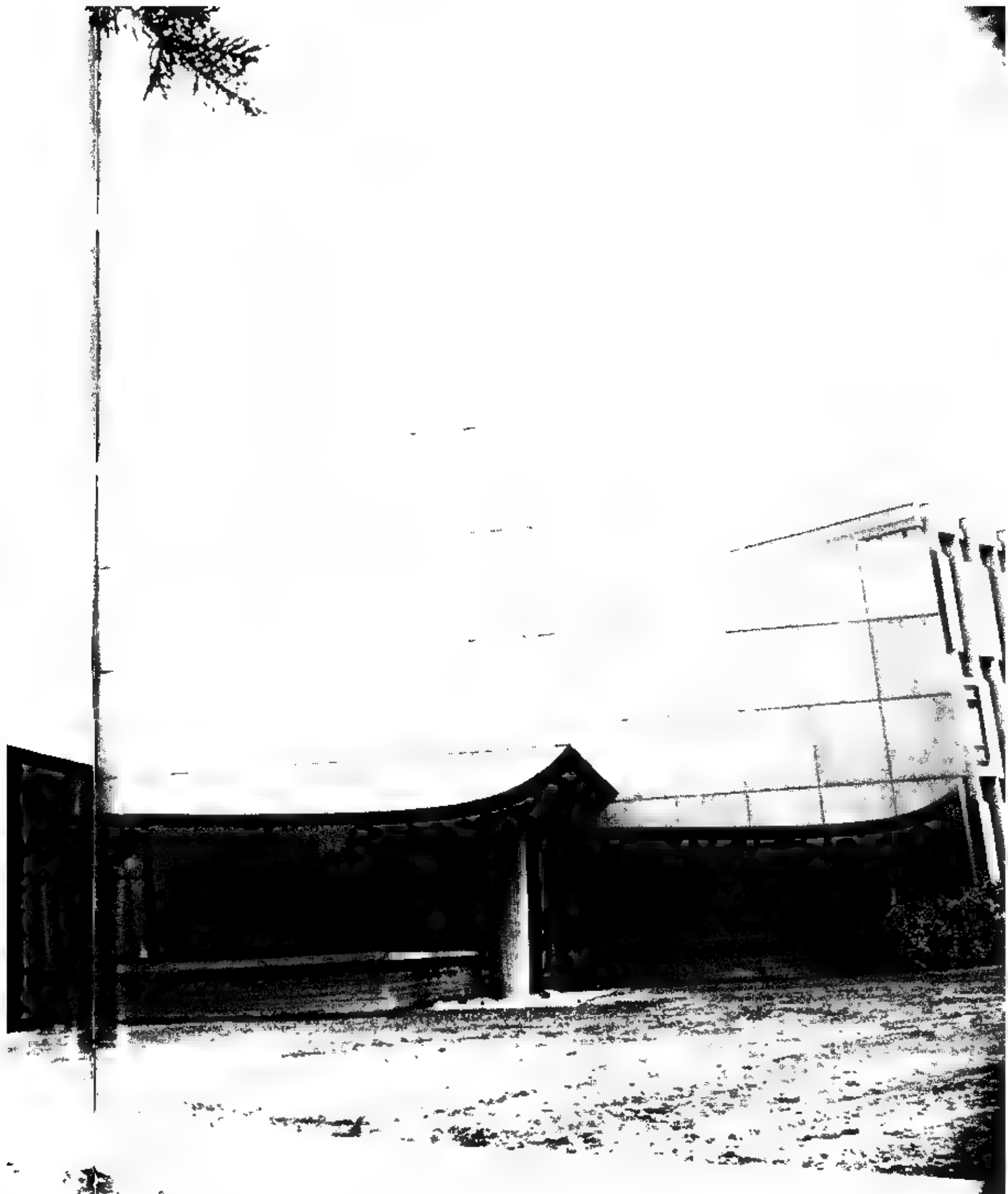
tire wear on vehicle stability using small scale models on an end-effector belt (see Plate 6.56).

- Almost from the moment he joined the Department, Dr. J.A.C. Kent fielded related research in unsteady gas dynamics and pulsating combustion. With financial support from NRC and DRB, he and his co-workers and students developed a novel air-breathing high frequency pressure-gain pulse combustor without moving parts based on his design, the Canadian Patents and Developments Ltd. built and exhibited a pulsed combustor warm air blower at industrial exhibitions held in Calgary and Toronto during 1975. An equipment defroster using his pulsed combustor was also developed for the Defence Research Board funded in part by a \$7,800 contract. To underline his expertise in this area, he was invited by Battelle Laboratories, Columbus, Ohio, to consult on their pulsed combustion systems research. Parallel with this work, he also conceived a modified axial flow Savonius wind turbine with Delta wing blades which exhibited good low velocity ratio torque characteristics and promised to be a simple, easy to construct, efficient power generator for developing countries. In some of this development he cooperated with Drs. Norrie and Walker (see Plate 6.48).



Dr. Mikulick's research on the effects of highway surface roughness and tire wear on vehicle stability using small scale models on an end-effector belt.





DYNAMIC MATURITY

During the last week in Apr. 1976 Dr. P.G. Glockner, Professor of Civil Engineering in the Faculty, was invited to become Chairholder in Mechanical Engineering. The invitation came from Dr. T.H. Barton who was acting on a unanimous recommendation of his Advisory Selection Committee supported also by an overwhelming majority of members of the Department. The Dean confirmed his offer in writing and summarized the main appointment conditions discussed and agreed to at their meeting. Upon reflection Peter Glockner accepted the challenge and was appointed Prof. and Head of the Department of Mechanical Engineering for a 5 year term effective July 1, an appointment promptly announced on May 14, 1976. In accordance with one of the appointment conditions, he retained his Professorship in Civil Engineering with the option to return to that department at the end of his term of office (see Plate 6.49).

Even before taking office and with the cooperation of the Head, Dr. A.G. Doige, the incoming Head proceeded with the search for and the hiring of 2 new staff members, a second condition of his appointment. Before the end of May he had finalized details of and recommended a 3 year limited term as Asst. Prof. for Dr. David J. Macom, effective Sept. 1, 1976 (see Plate 6.49). By the end of June a



P.G. Glockner



B.A. Maylor



M. Epstein



M. Epstein

Plate 6.49 The third Department Head with some of his first appointees

second young academic, Dr. Marcelo Epstein had agreed to join the Department. His appointment, with identical term, rank and starting date, was recommended in a letter dated July 2, 1976 (see Plate 6.49).

On that, his first day in the Chair, the new Head hired Mrs. Ida Pfisterer as replacement for Mrs. Arne da High who had resigned on April 27 after nearly 6 years of service. Ida Pfisterer stayed with Mechanical Engineering until July 25, 1978 when she became Dean's Secretary in the Faculty of Management. The Department was saddened to learn of her untimely sudden death at the Foothills Hospital on May 29, 1979.

Turnover in secretarial staff during the summer and fall of 1976 also included the resignation of Mrs. Ruth Hille at the end of September. She had been in Mechanical Engineering since March 27, 1969 and served as De-

partmental Secretary for over 2 years. Mrs. Betty Ann Maylor became the 4th Departmental Secretary effective Oct. 1, 1976 (see Plate 6.49). Her tasks were taken on by Mrs. Solange Bader who became full-time secretary to Prof. G.A. Karim for a period of over 10 years. In April '77, Miss Karen Odegard was hired who, as Mrs. Undseth, became one of the Department's long-serving senior secretarial staff members (see Plate 6.72).

The Fall '76 term started with 49 junior, 34 senior and 23 graduate students in Mechanical Engineering (see Fig. 6.5), the latter group including 9 PhD, 10 MSc and 4 MEng candidates. These statistics indicated good recovery of undergraduate and graduate enrolments in the Department (see Figs. 6.3 and 6.5). With such class sizes it was fortunate that, in addition to the 3 new academics (see Figs. 6.4 and 6.6), the teaching staff

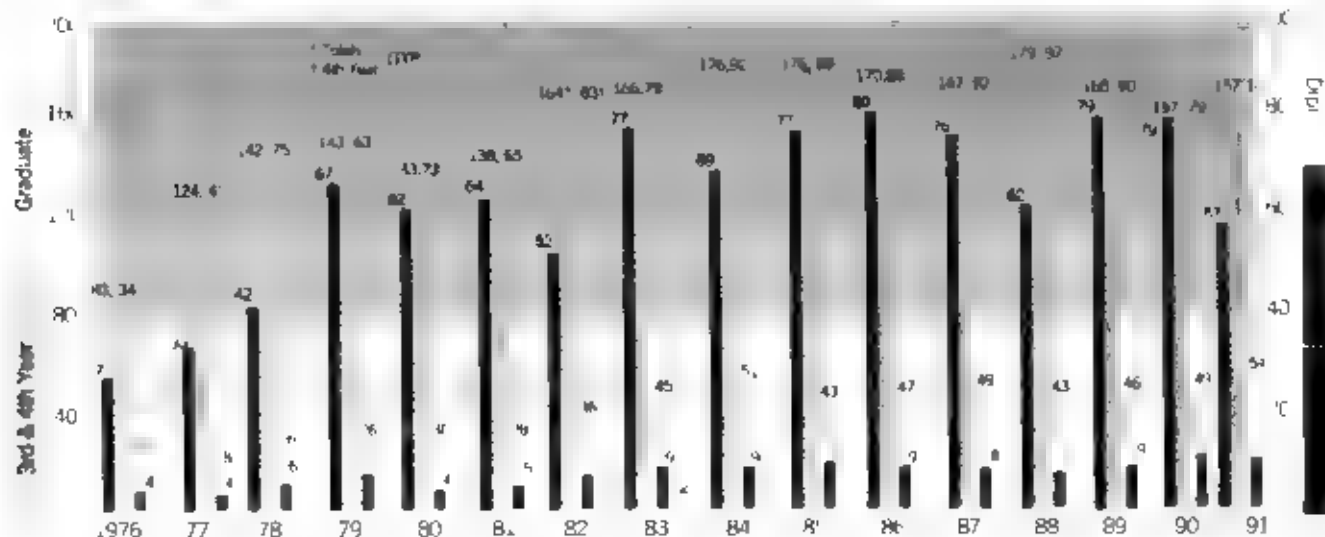


Fig. 6.5. Enrollment and Convocation Statistics for Mechanical Engineering 1976-1991.

Letter to Dr. P.G. Glockner from T.H. Barton, dated May 3, 1976.
Letter to Dr. T.H. Barton from P.G. Glockner, dated May 10, 1976.

Mechanical Engineering – 1976-1991

could be augmented by hiring some of the visiting and research appointees present in the Department, including Drs. P. L. Betts, G. S. Brar, K. L. Chowdhury and V. Ramesh. Dr. Chowdhury had worked with Prof. Glockner since 1971. He moved over into Mechanical Engineering in July 1976 (see Plate 6.55). When Philip Betts returned to Manchester on Dec. 31, 1976, Dr. John S. Turton from the University of Sussex took his place and became involved in undergraduate instruction during his stay, Jan. - May, 1977.

The first adjunct appointments in Mechanical Engineering were made during 1976-77. Dr. Hugh W. Jones from Physics was appointed Adjunct Prof. March 1, 1977 - June 30, 1979 in recognition of his collaboration in acoustics research with Drs. Vermeulen, Doige and Groves. His appointment was renewed and was in force until he moved to Dalhousie University on Dec. 31, 1979. To support Prof. Walker's efforts in initiating research related to mining equipment and coal technology, Mr. Terence Smith, Inspector of Mines at the Energy Resources Conservation Board was appointed Adjunct Assoc. Prof. Feb. 1, 1977 - June 30, 1978. The duo offered 2 extension courses on underground coal mining, one in each of the fall and winter terms of 1976-77.

The departmental programme re-

mained essentially unchanged during the period 1976-79. Emphasis on SI units was continued and the course expanded in 1976-77 after they had been introduced in accordance with Engineering Faculty Council's decision of May 9, 1975. A change was made in the offering of ENCI 461 - *Advanced Mechanics of Materials*, a course common for civil and mechanical engineering juniors, taught by Civil Engineering since Sept. 1967. The size of the combined class was growing and became a concern, especially after the record increase in freshmen registration in Sept. 1975. Consequently, the students from the 2 departments were split into separate lecture sections in late October 1975 with Dr. M. C. Singh taking over the lecturing for the mechanical engineering group. The class reacted very positively to this experiment. As a result, the departments agreed to separate the students on a permanent basis, each unit offering its own version of the course. The Fall '76 junior group in mechanical engineering became the first separate class in ENCI 461 with Mansa Singh as instructor. The Department introduced a new course ENME 487, in the Fall '77 term, to replace ENCI 461 in the mechanical engineering programme. It also added 12 new courses to its graduate programme during 1976-77.

A highlight for the seniors during the Fall '76 term was the rubber lugger



Rubber Lugger Contest At the 1976 Rubber Lugger Contest, a model designed and built by him during the senior design course, Rex's model was 14 cm long and 10 mm high and a single elastic band stretched across it. Holes in the band were 0.8 mm apart. The model travelled a record 279 m (351 feet) during one trial at an average speed of 1.52 m/sec (5.0 ft/sec). It won the Rubber Band Rally and led to the nationwide Fauvel-Eder Special Challenge Trophy Competition, sponsored by the Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA). Single-rubber-band-powered designs by Rex and JBC attained distances of 279 and 173 m, respectively in the spring of 1978.

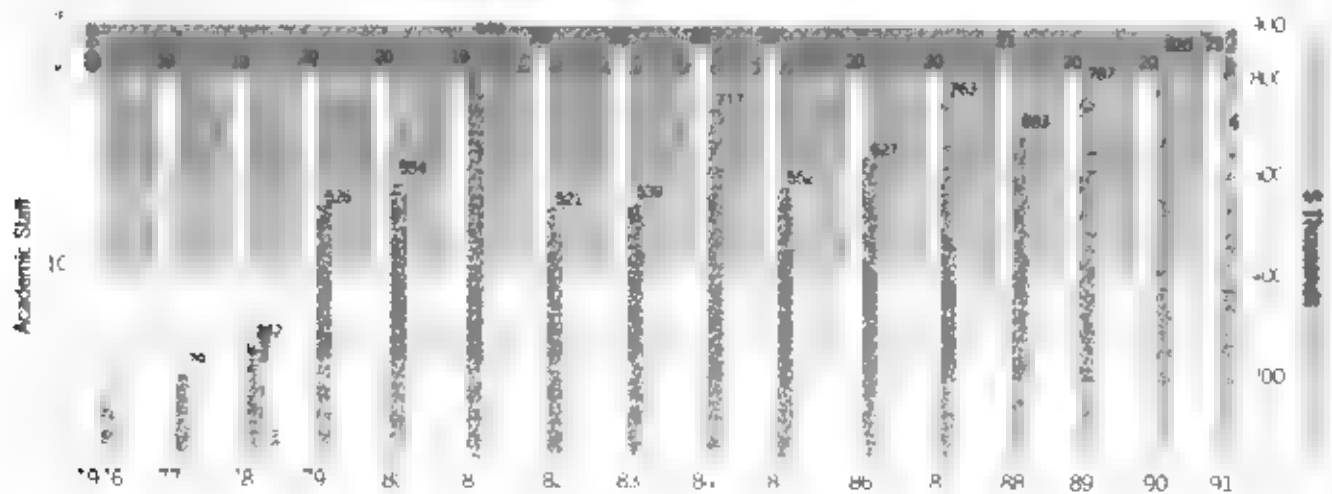


Fig. 6.6 Full-time Academic Staff and Annual External Research Funding in Mechanical Engineering, 1976-1991.

design competition introduced by Prof. Ernst Eder in the 4th year design course ENME 583. The students were challenged to design a single rubber band powered machine for maximum travel. Mr. O. Rod Fauvel's machine outperformed all other designs by a wide margin, covering a record 107 m. with intermittent stops. This very impressive design achievement resulted in a challenge being issued to engineering students in schools across Canada to beat The U of C record. The *Fauvel-Eder Special Challenge Trophy Competition*, sponsored by APEGGA, produced several designs that surpassed the Fauvel distance record (see Plate 6.50).

Amongst staff highlights we note the highly successful technical meeting of the International Combustion Institute, Canadian Section, organized in Banff by Prof. G.A. Karim and held for the first time in Western Canada May 26-27, 1977.

Turnover in academic staff began with the resignations of 3 staff members. Drs. G. deVries, A.K. Aston-Ekrem and Prof. E. Eder effective Dec. 31, 1976, May 13, and May 31, 1977 respectively. Gerry deVries took a senior position in industry but retained affiliation with the Department as Adjunct Assoc. Prof. until June 30, 1980. Aston-Ekrem decided to return to his native Norway while Ernst Eder accepted a position at the University of Technology, Loughborough, UK. As replacement, 3 young academics, Drs. Leslie E. Hajdo, Douglas W. Ruth and William E. White were recommended for a 3 year limited term

appointment as Asst. Prof., effective Sept. 1, 1977 (see Plate 6.53).

At spring convocation on June 10, 1977 the Department was pleased to see 30 members of its senior class receive their BSc degrees, 3 of them graduating with distinction, Messrs. Dana B. Laustsen, Henry G. Schlichter and Detlef G. Schulz, the first of whom was awarded the APEGGA Gold Medal. One of these 30 graduates was Miss Patricia L. Swan, only the second female to obtain a BSc degree from the Department after Miss Barbara Mathiesen graduated in 1970.

Creating home room facilities for the expected record junior enrollment was another job that had to be finished by September. Funds were obtained to quickly convert a laboratory room B-310, into an *auxiliary home room* and 2 staff offices along the north outside wall. The acute shortage in office space was further alleviated by partitioning off the north/outside end of the hallway between the existing home rooms by creating 2 inside (windowless) offices from a seminar room, and by constructing a further inside office and computer terminal room using the west end of the cryogenic laboratory room B-203. Renovations during the spring and summer of 1977 also included the removal of partitions in the main office to create a single large work area for the secretarial staff and the construction of 3 graduate student work spaces in room A-04.

As expected the Fa '77 enrollment set new records for the Department and the Faculty. There were 124 un-

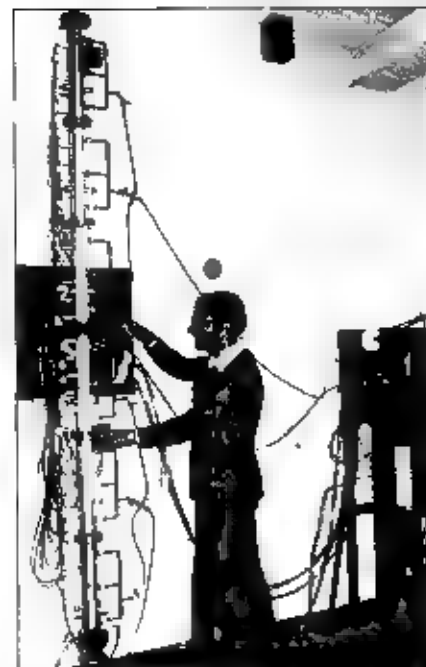


Plate 6.51 PhD candidate P.A. Badr in the Fire Research Laboratory is using his apparatus to study flame propagation in stratified media. ca 1976-77

dergraduates, including 83 juniors in Mechanical Engineering in September. Four members of this record 3rd year class were females, Misses Joanne T. Capie, Georgina M. Freeman, Wima E. Mitchell and Jan C. Organ, another first for the Department. The Department's physical facilities designed originally for 25-35 students in each of the junior and senior years, were stretched to their limits in coping with this student body. The mechanical engineering building extension, initially planned for 1972-73, was clearly long overdue and was



a. What else would you be doing at a Christmas party but eat and drink or sit and drink and eat? to R. A.K. Aston-Ekrem, Bill Anson, John Kenneth, Ghazi Karim, Isama Park & Clyde Heffley.



b. The new Head was playing his harmonium while others were enjoying the fine luncheon prepared and organized by the Departmental Secretary Mrs. Betty Ann Maylor. to R. A.K. Aston-Ekrem, P.P. Gupta, O.A. Badr, P.G. Glockner, C.A. Heffley, H.L. Chowdhury and M.C. Singh.

Plate 6.52 Staff and students in Mechanical Engineering, join their holiday celebrations at the Departmental Christmas Party on Friday, Dec. 24, 1976.



| Author | Year | Country | Age | Sample Size | Method | Findings |
|------------------|------|---------|-------|-------------|---------------|--|
| A. M. Vinogradov | 1971 | USSR | 10-14 | 100 | Questionnaire | High levels of self-esteem and social skills |
| V. G. Vinogradov | 1972 | USSR | 15-19 | 100 | Questionnaire | High levels of self-esteem and social skills |
| W. E. White | 1973 | USA | 10-14 | 100 | Questionnaire | High levels of self-esteem and social skills |

✓ get by manage

Graduate student numbers rose again to 18, including 9 PhD, 7 MSc and 2 MEng students. The school was able to continue working with the educational authorities in the USA and Canada to bring in a further two students from the USA and one from Canada. The school was able to attract a further 10 students from the USA, Canada, the Republic of Korea, the UK, Germany and Russia. Dr Ted G. Jang was also available for several teaching dates (see Plate 6.4). Further help came from the USA in 1994 when Dr Alexander M. Vukobratovic, who had been invited to give a lecture (see Plate 6.5), newly arrived and 10 immigrants joined the Desert

Dr. P. J. D. Macdonald, from eastern Canada, Dr. M. J. P. H. from Concordia University and Jack Odgers from York University were appointed visiting Professors for the period Sept '77 - July '79 and Sept '77 - Aug. '78, respectively. Dr. P. J. D. Macdonald was on a 2 year leave to work with a Calgary based Canadian version Study Team. Prof. Odgers spent his sabbatical working with Drs. Karm and Vermorel at the University of

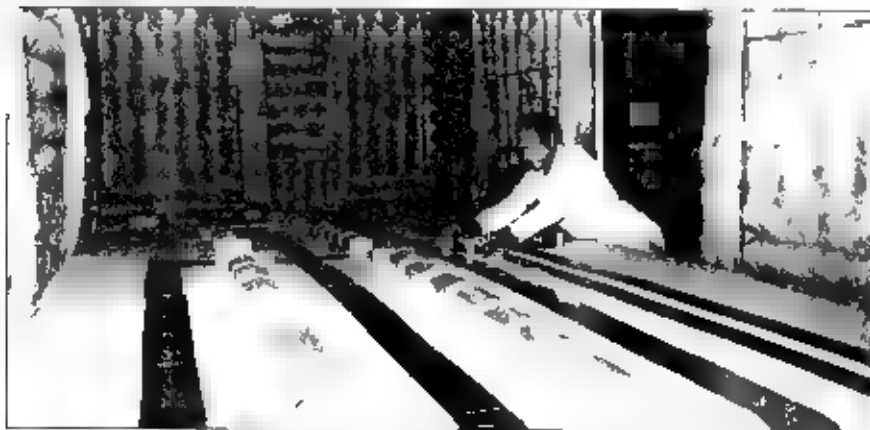
Further visitors Drs J. P. Nowak and J. I. Szuster (see Plate 6.60) but from Warsaw, arrived right after New Year 1978 to be research associates for a year with Profs. Glockner and cKrasinski, res. as above.

A departmental highlight during 1977-78 was the very successful seminar series on *Continuum Thermodynamics* with weekly lectures during the winter and early spring of 1978. Organized by Marcelo Epstein the success of the series was underlined by the strong attendance throughout and by the participation cutting across boundaries of specialization.

Staff highlights included a series of Kriem Resident Fellowships starting with an award to Dr. G. Waker for the winter '78 term. The fellowship allowed him to complete the second edition of his monograph on *Stirling Engines*. Dr. D.H. Norrie started a manuscript on *Technology and Society* during 1977-78 for the summer term, which he was awarded a Kriem Fellowship for the winter term of 1979. To complete the experience

tal phase of a project on acoustically controlled combustors. Dr P J Verdon, J.A.W., awarded the fellowship for the Fall '79 term. Dr J.A.C. Kent, F.R.S., research was recognized by a "travel award" for the Winter '80 term. The author is free to write a monograph on any steady, compressible flow

Staff changes included the departure of Dr. G. E. Smith on June 30, 1978, who took a position in local industry. To replace him, Dr. Andrew Pollard was appointed Asst. Prof. for a 3-year limited term, effective Dec. 6, 1978, after he had just completed his PhD studies at Indiana College (see Plate 6.5.3). At the end of August 1978, Mrs. Betty Ann Maylor, the Department's Secretary, resigned and left after being in Mechanical Engineering since Nov. 14, 1969. Mrs. Edie Schurz came on board on Sept. 5, 1978, and was to become one of the Department's most productive secretaries. Nearly a year elapsed before stability in the Department's Secretary's position was reestablished by hiring Mrs. Margaret van Koi, effective Aug. 8, 1979 (see Table 6.2 and Plate 6.7.2).



* S. face Transportation Noise and Attention Study

Undergraduate enrollment in Mechanical Engineering continued to grow. Undergraduate registration in Sept. 1978 with 67 junior and 75 senior full-time students. Graduate registration increased to 26 including 9 PhD, 12 MSc and 5 MEng candidates. The record sized final year class naturally led to a bumper crop of 67 graduates in 1979, including the above named 4 girls, statistics which set new department and faculty maxima that stood until 1983 when they were exceeded again by mechanical engineering convocation figures. The *mechanical advantage*, discussed in the previous section, was still very much in evidence.

After Andrew Pollard's arrival in December, the next full-time staff appoint-



K.K. Boros

M.J. Busi

K.L. Chowdhury

S. Dasi

H.P. Hufelmaier

P.D. Rowe

W.D. Shaw

Plate 6.55 Further academic appointments in Mechanical Engineering 1978-1981

ment was that of Dr. Kama K. Boros as Asst. Prof. for a 3 year limited term, effective Aug. 1, 1979 (see Plate 6.55). Kama Boros, a 1979 PhD graduate from the Department, was hired as replacement for Prof. Joseph deKrasinski who retired on June 30, 1979. Retirement, however, did not slow him down. After being appointed Prof. part time, he continued to teach his undergraduate and graduate courses and supervise graduate students and coworkers. He was still active some 14 years after retirement. In recognition of his many outstanding contributions to the Department, the Faculty and to his area of specialization, he was appointed Prof. Emeritus, effective July 1, 1980, the first such distinction in the Faculty.

The number of full-time academics increased from 19 to 20 when Dr. K.L. Chowdhury's long standing involvement in undergraduate instruction in the Faculty was acknowledged by appointing him instructor I for a 3 year limited term, effective Sept. 1, 1979. This appointment was upgra-

ded to the rank of Assoc. Prof. on May 1, 1981 and was followed by a tenure track in full term on July 1, 1982 (see Plate 6.55).

There was, naturally, some turnover in the Department's research sessional and visiting staff as well. For example, Dr. H.P. Hufelmaier arrived from Concordia University on Jan. 22, 1979 to be involved in undergraduate instruction in the Department and the Faculty for over 7 years. He was also part-time research associate with a number of staff, including Drs. Epstein, Gockner and Mikulick (see Plate 6.55). On Aug. 5, 7, Dr. W. Frydrychowicz arrived from Warsaw to work with Prof. M.C. Singh. He stayed to Sept. 30, 1980. During the summer of 1979, Dr. Dao Q. Dang accepted a full-time position at Mount Royal College in Calgary. Also on January 14, 1980, Dr. V. Ramesh decided to take a position in local industry and left. He returned in April of 1982.

Much time and energy was spent during 1977-79 in revising the department

tal programme, a task necessitated by the Faculty curriculum review. Particularly significant for Mechanical Engineering was the elimination of the common core courses, ENGG 305, Behaviour of Solid Materials and ENGG 307, Engineering Mechanics I. Dynamics of Rigid Bodies. Loss of these courses resulted in the introduction of 2 junior courses, ENME 421, Materials, and ENME 478, Rigid Body Dynamics, as well as a 4th year materials course, ENME 521, Materials.

On the recommendation of the Department's Curriculum Committee, Departmental Council also introduced 2 further new courses, ENME 479, Mechanics of Materials I and ENME 535, Mechanical Engineering Project. The major change in the 4th year programme was the formation of electives by introducing the requirement for 3 technical electives at least 2 of which are to be chosen from a given list of 6 courses. They are to be taken in addition to a certain core programme consisting of 7 courses, including ENGG 407, Numerical Methods for Engineers. The revised junior programme was started in the Fall '79 term while the new 4th year courses were first offered in the 1980-81 session except ENME 535 which was introduced in the 1979-80 academic year. Details of the evolution of the Department's senior programme towards the C.M. Minor during the period 1981-89 are discussed in Appendix H.

The Fall '79 registrations in Mechanical Engineering established once again a new maxima for the Department and the Faculty. Total undergraduate enrollment rose to 143, including a junior class of 80 with 5 female students. The 4th year group of 63 also included one female, for a total of 6 women undergraduates in the Fall of 1979, a new departmental record. Graduate student numbers remained steady at 26 comprising 6 PhD, 17 MSc and 3 MEng candidates.

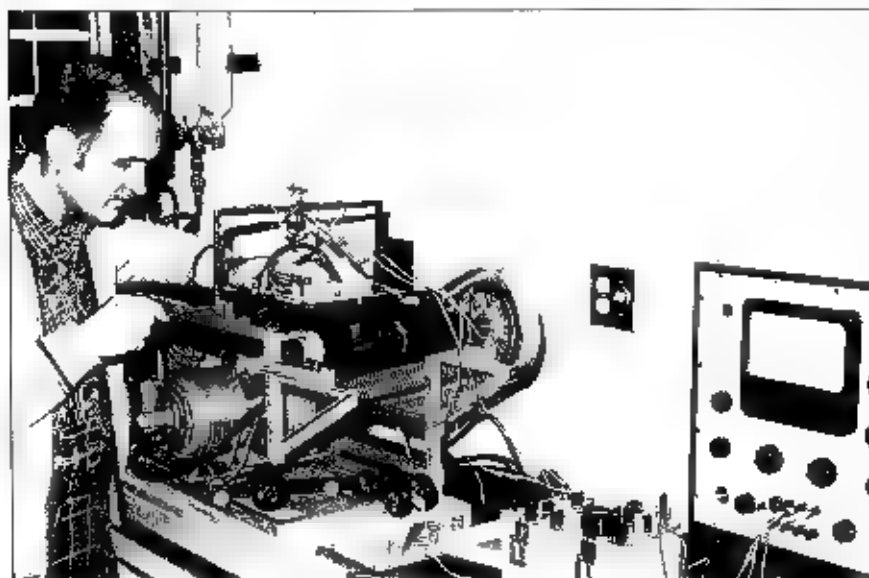


Plate 6.56 Dr. E. Mikulick is seen with his endless belt apparatus and recording instrumentation for work on testing small scale models for studying the effects of tire characteristics on the stability of vehicles as well as for other related units (ca. 1976-77)

Record high student numbers and highly personalized graduate classes, however, were not the only highlights involving the student body. In addition to the annual *rubber-tigger* competition, Dr. E.W. Johnson introduced the *egg-dropping contest* in the senior design course which helped to focus attention on the design component of the mechanical engineering programme (see Plate 6.6). A further highlight came from a 4th year student project when Mr. W. Dale Boghean won 3rd Prize in the CSME National Student Design Competition for development of a solar collector under the supervision of Dr. P.J. Vermeulen. The competition was held in conjunction with the society's annual meeting in Calgary, April 22-24, 1980 (see Plate 6.59). A group of mechanical engineering students designed a concrete toboggan and entered the first team from the Department in the 6th Annual Great Northern Concrete Toboggan Race, GNCTR '79 held at the Happy Valley Ski Hill in Calgary on Saturday, Feb. 24, 1979. Support for the project was provided by Esso Imperial Oil Ltd. and the Department. Members of this first mechanical engineering team in the GNCTR were Cameron and Dave, and in the following year, Doug Peizer, Todd McBride and Chris Bellis. The Department was shocked to learn of Doug Peizer's fatal

accident during the summer of 1979.

Amongst departmental events with an international flavour we note a most successful symposium on *Recent Developments in the Theory and Application of Generalized and Unrelated Media*, organized at The U of C, Aug 1-3, 1979, by Drs. M. Epstein, P.G. Glockner and D.J. Malcolm, with the assistance of Drs. K.L. Chowdhury and L.E. Hajdo. With participants from 9 countries, the meeting was sponsored by the American Academy of Mechanics, AAM, the Canadian Society for Mechanical Engineering's Division of Mechanics and Applied Mathematics, D.M.A.M., the National Research Council of Canada, NRC, Air Canada, CP Air, the Province of Alberta and The U of C. A second major international meeting, the *3rd Int. Conference on Finite Elements in Flow Mechanics*, also a huge success, was organized in Banff, June 10-13, 1980, by Prof. D.H. Norrie with Dr. A. Pollard assisting.

The Department's explosive growth in research activity was a further source of joy and pride. This expansion is underlined by many outstanding scholarly achievements, a few examples of

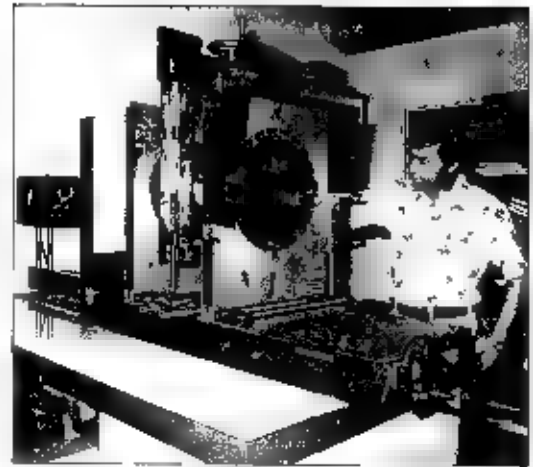


Fig. 6.58. P.G. Glockner, E. Tordella, and D.J. Malcolm, with the assistance of Drs. K.L. Chowdhury and L.E. Hajdo, organizing the 3rd Int. Conference on Finite Elements in Flow Mechanics, Banff, June 10-13, 1980.

which are reviewed below. It is also indicated by the increase in graduate student numbers, in external research funding and in the size of research personnel (see Figs. 6.5 and 6.6). All of this activity and momentum helped to create an air of optimism and excitement, generated in large part by the dynamism and vigor of the young staff members who in 1979 constituted 40% of the Mechanical Engineering staff. This dynamism blended well with the experience and maturity of the senior academics, producing an atmosphere referred to here as *dynamism/maturity*, an environment which persisted and withstood the massive staff turnover which lay ahead.

The Department's positive and stimulating environment was reinforced by external events and conditions. One notes that the late 1970's were the years during which the *oil patch boom* reached its peak and most segments of the economy and society were pervaded with an almost unbelievable belief in never-ending growth and expansion. Within the institution, and specifically in the faculty, there was renewed optimism and excitement about the future after approval of the surveying engineering programme and civil engineering building extensions were announced in June 1979. This decision provided a glimmer of hope to the departments, including Mechanical Engineering, in having their plans for urgently needed physical facilities become reality.

Along with beneficial influences, the buoyant economy also had negative



Fig. 6.59. W. Dale Boghean, 4th year student, working on a solar collector project, winning 3rd Prize in the CSME National Student Design Competition, Calgary, April 22-24, 1980.

effects on the institution. In the Faculty Mechanical Engineering was one of the units most affected being hardest hit in terms of staff turnover. Most critical was the loss of 7 full-time academics during the period July 1980-June 1982. The first 3 resignations came from Drs. D.W. Ruth, L.E. Hajdo and D.J. Malcolm effective June 30, Aug. 31 and Dec. 31, 1980 respectively. All 3 went into industry, the former 2 in Calgary and the latter in Toronto. To retain some affiliation with the Department, Doug Ruth was appointed Adjunct Assoc. Prof. for a 3-year term starting July 1, 1980. A similar appointment for Leslie Hajdo was delayed until Nov. 1, 1982 from which date on he held an adjunct appointment until his move to Houston on Oct. 31, 1990.

To find replacements for these academics under the prevalent economic conditions and at such short notice was no small task. Fortunately there were sessional and research staff on hand who were interested in a more permanent position in the Department. One such staff member was Dr. Martin J. Bush, a sessional instructor in Chemical Engineering since Jan. 1, 1977, who had been collaborating with Drs. Ruth and Norrie on a research project. He was appointed to an initial term as Asst. Prof. starting July 1, 1980, replacing Doug Ruth (see Plate 6.55). Lady Luck was smiling on the Department as so when a request for an extra full-time academic position was approved by the

newly created Position Allocation Committee allowing the appointment of Dr. Oleg Vinogradov to an initial term as Asst. Prof. effective July 1, 1980 (see Plate 6.53).

There was substantial turnover in visiting, research and sessional staff as well. Some six weeks after Dr. Ramesh accepted a position in industry 2 visitors from Warsaw, Drs. Jada Wierzbka and A. Teodorczyk arrived on March 1, 1980. They both came to collaborate with Prof. Karim, the former returning to The U of C after having spent a year in Chemical Engineering, July 1978-July 1979. The latter went back to his homeland on Dec. 31, 1980. On Aug. 4, Dr. Sadik Oost from Turkey joined Prof. Glickner as Research Associate. Dr. Alexandra M. Vinogradov moved over into Civil Engineering on Sept. 1, 1980 after she had been awarded an NSERC University Research Fellowship and had been appointed to a limited term as Asst. Prof. in that Department. To compensate partly for this move Dr. Souad M. Khalil, Research Associate in Civil Engineering, looked after some of the Department's common core laboratories during 1980-81. In addition Dr. A.S. Hanaf, an AOSTRA PDF and recent PhD graduate (see Plate 6.62), was appointed part-time sessional instructor for 1980-81. When offered a full-time permanent position elsewhere, he resigned and left on Oct. 31, 1980. His teaching assignments were taken over by Dr. K.O. Kessey who had arrived



Plate 6.53 Dr. Oleg Vinogradov and Dr. Souad M. Khalil standing next to a large, dark, cylindrical object, possibly a piece of equipment or a large container.

on Oct. 20 from Kumasi, Ghana, to work with Prof. Glickner on thermodynamic aspects of greenhouses.

Turnover in support staff during 1980 was also significant. It included the retirement on June 30th of the technical supervisor Mr. John Holdsworth and that of a technician, Mr. Clyde

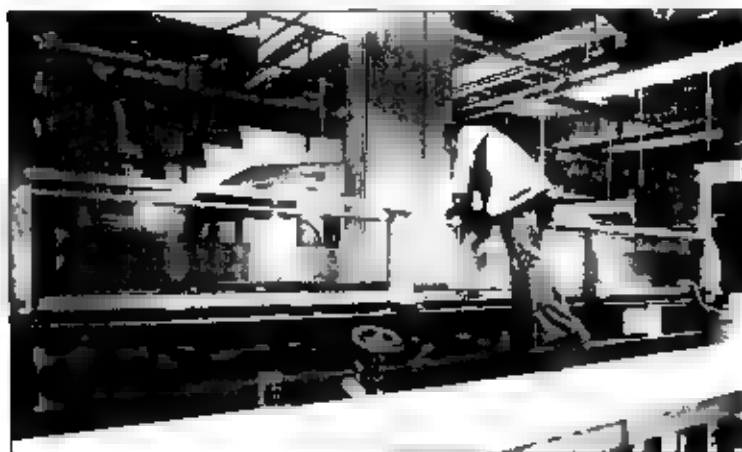


Plate 6.60 Dr. T. Szuster from the Faculty of Engineering, U of C, working in a water tunnel, possibly a fluid dynamics experiment.

Plate 6.60 Dr. T. Szuster from the Faculty of Engineering, U of C, working in a water tunnel, possibly a fluid dynamics experiment.



Plate 6.61 Dr. T. Szuster working in a laboratory setting, possibly a water tunnel or a similar fluid dynamics experiment.



a Simon H.W. Young is ready to test his egg-dropper on the 2nd floor of the Central Foyer in the Engineering Complex. L to R: Dr Ed C. Mikulak, Simon H.W. Young, Raymond T.W. Tait, both in their mechanical engineering seniors, and the Engineering Student Society's official photographer, chemical engineering, junior Douglas H. Cole



b Course instructor Dr Eric W. Johnson, C.E., supervising the drops by senior Randall M. Kupper, L, with classmate Peter R. Corns looking on

Plate 6.6 Prof. Eric W. Johnson challenged the students in the senior design course to devise a method or scheme for dropping raw eggs from the second floor corridor of the Central Foyer in the Engineering Complex onto the slate floor at ground level, without breaking them. The design competition, which became known as the **egg-dropping-contest**, was run during the winter term, starting in 1980 (Winter 8).

Heffley, John Holdsworth was an excellent technical supervisor for 13 years who insured strong and efficient technical support and the smooth running of the Department's laboratories. Mr W.A. Anson was appointed his successor and Mr R.W. Gustafson became Technical Officer I effective July 1, 1980. Technical and secretarial staff hired as replacements included Messrs. Gregory East and Gerry Bolton and Misses Kathy Zabin and Margaret Stephens.

The Department was still recovering from the loss of 3 of its academics when Drs. Kamal Botros, Martin Bush and Andrew Poirard handed in their resignations between Feb. 6 and

March 10, effective April 15 for the first and June 30 for the latter two. The Department rebounded by appointing Drs. S. Dost, R.D. Rowe and W.J.D. Shaw as Assoc. Prof. effective July 1, 1981 (see Plate 6.55). Richard Rowe had been a staff member in Chemical Engineering since Sept. 1, 1969. The other two were given 3 year initial term appointments. A new arrival on campus, Prof. Benno Nigg from the Technical University of Zürich (ETH) was appointed Professor in Physical Education and in Medicine in view of his area of specialization, biomechanics. He sought association with the Department and was appointed Adjunct

Prof. on April 1, 1981 (see Plate 6.69).

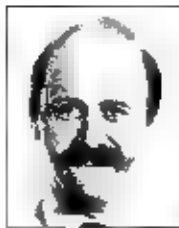
The Department continued to attract outstanding visiting and research personnel. For example, on Jan. 1, 1981 Prof. Stanislaw A. Lukaszewicz arrived from the Technical University of Warsaw. Some 6 weeks later Drs. C.W.S. To and G. Ahmadi joined the Department on Feb. 9 and 10, respectively. Solomon To, a 1975 MSc graduate, returned to work with his former supervisor, Prof. Doige, after completing his doctoral studies at the University of Southampton. He was given a sessional appointment as Asst. Prof. for 1981-82. His successful application for an NSERC University Research Fellowship led to a 3 year limited term appointment which was extended on July 1, 1985, when the JRF was renewed until June 30, 1987. He resigned and left on June 30, 1986 to take a tenure track position at the University of Western Ontario (see Plate 6.63). Goodarz Ahmad collaborated with Prof. Glockner and held sessional appointments in Mechanical Engineering until his resignation on Dec. 31, 1981. New research and sessional staff also included Drs. M. Eizanowski and O.R. Faive. Marek Eizanowski came to the Department from Warsaw via Nairobi, Kenya. From the day of his arrival on Nov. 8, 1981 to April 30, 1988, he was collaborating with Prof. M. Epstein and



Plate 6.62 Some of the Department's graduate students are celebrating with Dr. A.S. Havarati his successful dissertation defence. L to R: Abdelreham Z.E. Taha, E.S., Pethrick W.D. Abdalabbah, M.A., Tessari, M.A., Goughing, Kubrya M.B., Janna M.A., Goughing, King, R., Havarati A.S.A., Buor, S., Ogundele G., Panfilio, V.P., Al-Alosi, Y.H. Dec. 7, 1979



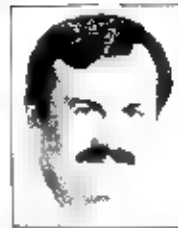
M. E. Szwedowski



O.R. Faiver



S.A. Lukaszewicz



W. Szwedowski



W. Szwedowski



W. Szwedowski



W. Szwedowski

Plate 6.64: Photos of the members of the Mechanical Engineering Department, 1981-84

was a steady and reliable sessional staff member in Mechanical Engineering (see Plate 6.63). Rod Faiver returned from his PhD studies at the University of Newcastle upon Tyne in Sept. 1981 to become involved in Dr. Walker's 3 year, \$750,000 string engine development contract with the Transportation Development Centre (TDC) in Montreal (see Plate 6.66).

Amidst all this staff turnover, the Department was faced with the task of filling the Head's position. After a review, Dr. P.G. Glockner was reappointed but only for a 3 year term (July 1, 1982 - June 30, 1985) to satisfy the newly instituted GFC guidelines which limited the term of office to 8 years. The Head went on sabbatical leave on July 1, 1981 and Prof. A.G. Dodge was appointed Acting Head for a year.

The 2 academic vacancies created in 1981-82 were partly compensated for by appointing Drs.

Snigmon To and Goodarz Ahmadi as part-time sessional instructors. Further staff problems arose when, on March 1, 1982, despite dark clouds of recession threatening in the horizon, B. White resigned, effective May 1. He was appointed Adjunct Assoc. Prof. starting June 1, 1982, a position he held until June 30, 1987 when he became Dean at Ryerson Polytechnic Institute in Toronto.

After his return from sabbatical leave, the Head recommended the appointment of Drs. S.A. Lukaszewicz, Wierzbica and O.R. Faiver to an initial term as Prof., Assoc. Prof. and Ass. Prof. respectively, effective Sept. 1, 1982 (see Plate 6.63). With these appointments, the 3 vacancies were filled and the period of rapid academic staff turnover in Mechanical Engineering came to an end. The day before these appointments went into effect, Dr. W. Szwedowski arrived from Warsaw. He was to work with Prof. Glockner as Research Associate and serve as ses-

sional instructor in the Faculty until August 1986 when he accepted a full-time position at the University of Saskatchewan in Saskatoon (see Plate 6.63). Other visitors included Prof. Harley Cohen from the University of Manitoba who spent the Winter '82 term in the Department as a visiting Kilam Fellow. It is noteworthy that 2 other successful applications for such fellowships brought Prof. Gerald Wemp-



Plate 6.65: Prof. Gerald Wempner, Research Associate, Mechanical Engineering, 1982-83. He was appointed as a visiting Kilam Fellow in the Department in the Winter '82 term. He has been associated with the Department since then, collaborating with a number of academics in Mechanical Engineering (see Plate 6.63). Also in 1984, Prof. A.A. Torvi accepted a 1/3 appointment in Continuing Education as Director of Engineering Programmes, a position he held until June 30, 1988. This development was partially offset by Dr. E. W. Robinson's return to the Department on a part-time basis on June 30, 1985 after completing his second 5 year term as Assoc. Dean (Student Affairs). The Department's manpower was augmented also by the arrival of Dr. R. Petea who returned on June 24, 1985 to continue his cooperation with Prof. Karim. He held sessional appointments until his departure in May 1989. In the Fall of 1986, Dr. W. Swisterski joined Prof. Glockner as Research Associate and became involved in undergraduate

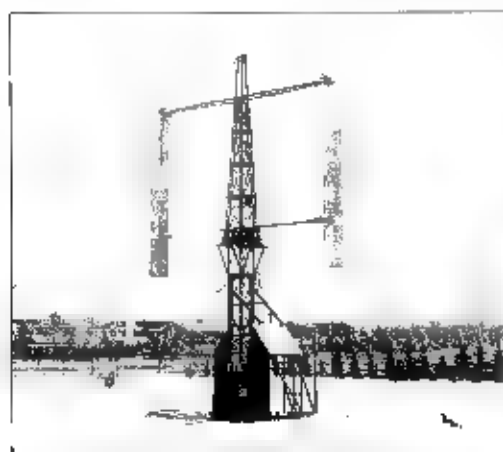


Photo 6.66: The large well working rig at the site of the first oil well in the province of Alberta, near the town of Leduc, 1940s. The rig was built by the Canadian Government and was used to drill the first oil well in the province of Alberta, near the town of Leduc, in 1940.

Photo 6.67: The well head of the first oil well in the province of Alberta, near the town of Leduc, 1940s. The well head was built by the Canadian Government and was used to drill the first oil well in the province of Alberta, near the town of Leduc, in 1940.



Photo 6.68: The well head of the first oil well in the province of Alberta, near the town of Leduc, 1940s. The well head was built by the Canadian Government and was used to drill the first oil well in the province of Alberta, near the town of Leduc, in 1940.

An unusually high rate of secretarial staff turnover during 1984-86 provided additional challenge for the Head. It started with the resignation of Miss Kathy Zibin on July 23, 1984, after being in the Department for almost 4 years. Mrs. Valerie Snowden was hired on September 1 as replacement. She left in March, 1985 to become administrative secretary to the Dean of Management. Next, Mrs. Margaret Ringer (nee Stephens) resigned on Aug. 16 to take a position in Academic Administration from which she moved to become administrative assistant to the Secretary of GFC. New additions to the secretarial staff included Mrs. Maria B. Berry and Ms. Gail Jones, starting Aug. 19 and Sept. 4, 1985, respectively. At the end of September Mrs. Margaret van Koll, the Departmental Secretary, resigned. She decided to retire and move back to her native Holland. Gail Jones agreed to look after her duties on an interim basis. On Oct. 7, Mrs. Elsie Schulz moved over into the Dean's office after more than 7 years in the Department. She was to become Dean's Secretary on Feb. 1, 1987 and Administrative Assistant to the Dean of Law, on Oct. 18, 1993. Mrs. Inge Timmermanns was hired as her replacement on Oct. 16, 1985. Mrs. van Koll's successor, Miss Kathleen M. M.

Further changes in technical staff occurred in 1989 when the Faculty's computer numerically controlled machining centre was transferred to Mechanical Engineering. Messrs. B S



A change in departmental administration occurred on July 1, 1987 when Prof. Peter Glockner stepped down from the chair. An unsuccessful round of advertising for a Head led to the



1. $A \rightarrow B$ M_1 M_2 M_3 M_4 M_5 M_6 M_7 M_8 M_9 M_{10} M_{11} M_{12} M_{13} M_{14} M_{15} M_{16} M_{17} M_{18} M_{19} M_{20} M_{21} M_{22} M_{23} M_{24} M_{25} M_{26} M_{27} M_{28} M_{29} M_{30} M_{31} M_{32} M_{33} M_{34} M_{35} M_{36} M_{37} M_{38} M_{39} M_{40} M_{41} M_{42} M_{43} M_{44} M_{45} M_{46} M_{47} M_{48} M_{49} M_{50} M_{51} M_{52} M_{53} M_{54} M_{55} M_{56} M_{57} M_{58} M_{59} M_{60} M_{61} M_{62} M_{63} M_{64} M_{65} M_{66} M_{67} M_{68} M_{69} M_{70} M_{71} M_{72} M_{73} M_{74} M_{75} M_{76} M_{77} M_{78} M_{79} M_{80} M_{81} M_{82} M_{83} M_{84} M_{85} M_{86} M_{87} M_{88} M_{89} M_{90} M_{91} M_{92} M_{93} M_{94} M_{95} M_{96} M_{97} M_{98} M_{99} M_{100} M_{101} M_{102} M_{103} M_{104} M_{105} M_{106} M_{107} M_{108} M_{109} M_{110} M_{111} M_{112} M_{113} M_{114} M_{115} M_{116} M_{117} M_{118} M_{119} M_{120} M_{121} M_{122} M_{123} M_{124} M_{125} M_{126} M_{127} M_{128} M_{129} M_{130} M_{131} M_{132} M_{133} M_{134} M_{135} M_{136} M_{137} M_{138} M_{139} M_{140} M_{141} M_{142} M_{143} M_{144} M_{145} M_{146} M_{147} M_{148} M_{149} M_{150} M_{151} M_{152} M_{153} M_{154} M_{155} M_{156} M_{157} M_{158} M_{159} M_{160} M_{161} M_{162} M_{163} M_{164} M_{165} M_{166} M_{167} M_{168} M_{169} M_{170} M_{171} M_{172} M_{173} M_{174} M_{175} M_{176} M_{177} M_{178} M_{179} M_{180} M_{181} M_{182} M_{183} M_{184} M_{185} M_{186} M_{187} M_{188} M_{189} M_{190} M_{191} M_{192} M_{193} M_{194} M_{195} M_{196} M_{197} M_{198} M_{199} M_{200} M_{201} M_{202} M_{203} M_{204} M_{205} M_{206} M_{207} M_{208} M_{209} M_{210} M_{211} M_{212} M_{213} M_{214} M_{215} M_{216} M_{217} M_{218} M_{219} M_{220} M_{221} M_{222} M_{223} M_{224} M_{225} M_{226} M_{227} M_{228} M_{229} M_{230} M_{231} M_{232} M_{233} M_{234} M_{235} M_{236} M_{237} M_{238} M_{239} M_{240} M_{241} M_{242} M_{243} M_{244} M_{245} M_{246} M_{247} M_{248} M_{249} M_{250} M_{251} M_{252} M_{253} M_{254} M_{255} M_{256} M_{257} M_{258} M_{259} M_{260} M_{261} M_{262} M_{263} M_{264} M_{265} M_{266} M_{267} M_{268} M_{269} M_{270} M_{271} M_{272} M_{273} M_{274} M_{275} M_{276} M_{277} M_{278} M_{279} M_{280} M_{281} M_{282} M_{283} M_{284} M_{285} M_{286} M_{287} M_{288} M_{289} M_{290} M_{291} M_{292} M_{293} M_{294} M_{295} M_{296} M_{297} M_{298} M_{299} M_{300} M_{301} M_{302} M_{303} M_{304} M_{305} M_{306} M_{307} M_{308} M_{309} M_{310} M_{311} M_{312} M_{313} M_{314} M_{315} M_{316} M_{317} M_{318} M_{319} M_{320} M_{321} M_{322} M_{323} M_{324} M_{325} M_{326} M_{327} M_{328} M_{329} M_{330} M_{331} M_{332} M_{333} M_{334} M_{335} M_{336} M_{337} M_{338} M_{339} M_{340} M_{341} M_{342} M_{343} M_{344} M_{345} M_{346} M_{347} M_{348} M_{349}



The growth in undergraduate and graduate enrollments and number of graduands, was also quite substantial during this period. As is seen from Fig 6, the total undergraduate student numbers increased, reaching peaks of

A snapshot of part of this staffing history is summarized on Fig 6.6 which indicates the number of academics increasing from 16 in 1975-76 to 22 in 1982.

Fig. 6.5 also indicates the increase in graduate enrollment from 18 students in 1977 to 51 in 1984. Thereafter graduate student numbers varied between 43 and 49 until a maximum enrollment of 54 was reached in 1991. The number of graduate degree recipients



ents varied between 4 and 11 during the same period, establishing departmental maxima for the number of MSc and MEng graduates per year, 8 and 3, respectively. It is noteworthy that the first female graduate student was Mrs. Haina L. Motruk who began her MSc programme in 1982 and became the first woman graduate degree recipient in the Department at spring convocation in 1985 (see Plate 6.68). In Sept. 1983 Miss Catherine J. Lauresher became the first female BSc graduate from the Department who continued her studies here towards an MSc degree. Three years later she transferred into a PhD programme thereby also becoming the first female doctoral student and candidate in Mechanical Engineering at The U. of C. (see Plate 6.68). Mrs. Heiolsa S. Alves became the first female MEng candidate when she registered in Sept. 1983. She transferred into an MSc programme in 1984 and obtained her degree at convocation on June 5, 1987 (see Plate 6.68).

One of these 3 students, Cathy Laurushen, made headlines when she was given the opportunity to conduct some of her bubble-group experiments aboard a spacecraft in March.



4. The Legislature shall determine whether the Attorney General is to be elected by popular vote.

A senior year student project by Mr. Daryl J. Caswe, supervised by Dr. W. D. Shaw, was also publicized widely. It dealt with a metallurgical investigation of a special purpose knife for shaping oboe reeds. Mr. Caswe had approached Prof. Shaw with the problem to which the latter suggested a heat treatment method for altering the microstructure of the steel, reducing the carbide particle size in the steel matrix so as to increase the hardness and wear resistance of the knife edge. The new oboe reed knife won second prize at the 1986 International Metallographic Exhibit in Boston, Aug. 3-6, 1986, in the Entrepreneurial Design Category of the Western Engineering



Competition in Saskatoon, March 9, 1987 and in the Canadian Engineering Design Competition in Edmonton, March 23, 1987. At the same meeting in Edmonton, the oblique knife also won the national Texaco Technical Excellence Award.

this distinction. While an undergraduate, Stephen Vermeulen was awarded the Suncor Inc. Scholarship in Engineering in 1980; the Alberta Heritage Louise McKinney Scholarship in 1981 and 1982. He graduated with distinction in 1983, won the APEGGA Gold Medal and was selected as the first winner of the Engineering Institute of Canada's Student of the Year Medal presented at EIC's annual meeting at the Petroleum Club on May 17, 1983. His PhD studies in biomechanics were funded by the prestigious \$15,000 Alberta Heritage Ralph Steinhauer Award of Distinction, which he held for 2 years and for which he was the first recipient in the Faculty. Support also came from the Medical Research Council of Canada.

One of the major departmental highlights was the official opening of the \$0.75 million Harris Computer Gra-



Plate 6 72 The Mechanical Engineering Secretarial Staff

ph's Faculty on May 11, 1983 acquired through a donation from the Harris Corporation, Fort Lauderdale, Florida, and a matching grant from the Province. On the same afternoon the Faculty's \$175,000 computer numerically controlled (CNC) Matsura Machining Centre was also officially opened (see Appendix H for details). These ceremonies were timed so as to coincide with the start of the First Canadian Universities Conference on Computer Aided Design/Graphical Manufacturing, CAD/CAG/CAM, May 12-13, hosted by the Department and organized by the Department's Computer Integrated Manufacturing Group spearheaded by Dr. D.H. Norrie and including Drs. S. Dost, O.R. Fauve and E.C. Mikulcik and Prof. A.A. Torvi. Other major conferences during the year under review include the Faculty's Symposium on Large Engineering Systems, held at The U of C June 9-11, 1982 and organized under the chairmanship of Dr. M.C. Singh with Drs. E.C. Mikulcik and D.H. Norrie as mechanical engineering members of the organizing committee. After their first meeting in May 1977, Prof. G.A. Haddad with the assistance of Dr. W. J. G. and others, organized further very successful meetings of the International Commission on Institute Canadian and Western States Sections held at Banff May 9-12, 1982, Apr. 27-30, 1986 and April 28 - May 2, 1990 respectively. The Pacific Northwest Section of the American Society of Engineering Education



Figure 1: A person in a white lab coat working with a large, complex mechanical or electrical apparatus, possibly a wind tunnel or a large-scale testing rig, in a laboratory setting.



Figure 2: Two men in suits standing together, one holding a framed certificate or award.



Figure 3: A man in a suit and tie looking down at a document or book he is holding.

Figure 4: Distinguished Alumni Award presentation ceremony.

ASEE apparently was also influenced by the unique scenery of the Canadian Rockies. After their 33rd annual meeting at the Banff School of Fine Arts, in May 1971 they returned to the Banff Springs Hotel for their 42nd and to The U of C for their 51st annual meeting on May 13, 1980 and May 11-13, 1989 respectively. Prof. A.A. Torvi was Programme Chairman for both of these conferences. Prof. Marcelo Epstein was involved in organizing one of the institutional highlights of the year, The International Symposium on Science, Music, and Science, held at the University of Alberta, June 16-19, 1989. This unique event, supported generously by the university and other institutions was received most enthusiastically by the media as indicated by numerous interviews, reviews and entire programmes devoted to the Festival including 2 full CBC Arts National broadcasts. It brought together astronomers, physicists, engineers, historians of science, musicologists, instrument builders and performing artists from around the globe who in an atmosphere of harmony and through interdisciplinary intercourse demonstrated the artificiality and fragility of traditional disciplinary boundaries. The Festival served as a significant reminder of the importance of a real university.

A series of one day meetings were organized by the department in cooperation with the Calgary Section of the Canadian Society for Mechanical Engineering. The first of these CSME/Dept. of Mech. Eng. seminars, dealing with *Current Energy Related Developments*, was

held Feb. 14, 1986 at the Village Park Inn and was organized by Drs. S. Dost, O.R. Fauve and Prof. A.A. Torvi. The next one was held Feb. 20, 1987 at the Highlander Hotel and was organized by Sadik Dost with Ed Mikulcik and Alan Torvi assisting. The theme was *Recent Developments in Mechanical Engineering* which was also the topic for the third seminar held Feb. 16, 1989 at the Airport Sheraton Inn, with the same organizers.

In addition to the student, staff and departmental highlights discussed above or depicted on pages 10-11, the following few examples are briefly reviewed from amongst the many significant staff-related events and achievements.

- Prof. Joseph S.A. Pokrasinski's research continued to attract international attention. For example, he was invited by the Chinese Academy of Sciences for a 2 week lecture series in Beijing on blast attenuation of foams. During his visit Aug.-Sept. '80, he also toured their aerodynamic facilities and provided research advice. His work on shock attenuation of foams also sparked the interest of the U.S. Army who invited him to deliver a lecture at their Aberdeen Proving Grounds Lab. in Oct. 1980.

His experience and expertise in wind tunnel design was acknowledged by an invitation and a grant from the Royal Norwegian Research Council to spend 3 months April-July 1982 at the Division of Aero and Gas Dynamics of the

Institute of Technology in Trondheim where he provided guidance in the design of a large wind tunnel for testing offshore oil drilling rigs. He was invited back to Trondheim in the summer of 1983 and 1984 for the calibration and final testing phases of the facility.

In 1984 he was asked by the organizers of the 1988 Olympic Winter Games and Alberta Public Works to carry out wind tunnel micro-climate studies of the Nakiska Ski area at Mount Allen and the Olympic Nordic Ski Events area in Canmore studies which contributed to the final design of these Olympic sites.

- In December 1976 Prof. P. G. Glockner was awarded a \$17,000 grant from the Alberta Gas Trunk Line Co. Ltd. (AGTL) re-named Nova Corporation for a feasibility study on using waste energy from compressor stations in inflatable greenhouses. He collaborated with Drs. D. J. Malcolm and Roger Mellor. With results from this study a proposal was submitted resulting in a 4 year \$100,000 NSERC Strategic grant for work on *The Use of Waste Energy in Greenhousing and Agriculture*. The study (Nov. '78 - Nov. '81) attracted widespread attention. It helped to bring into the Department and/or support such

visitors and staff as Drs. G. Ahmadi, S. Dosi, K. O. Kessey, J. Kolar, S. A. Litkaszewicz, V. Ramesh, A. M. Vinogradov, O. G. Vinogradov.

In the spring of 1979 a joint application with Dr. M. Epstein to EMR resulted in a 4 year \$59,000 study on surface subsidence due to underground coal mining in the Western Canadian Foothills. Dr. H. P. Huttenmaier and 2 research assistants were active on the project which also provided an opportunity to develop contacts with the staff of CANMET in the University Research Park.

- A widely publicized project also was the *Program for interactive Simulation of Complex Environmental Systems, PISCES*, supported by a \$50,000 grant, May '79 - Dec '80 from DAEM. Its principal investigators, Drs. D. W. Ruth and D. H. Norrie, with the assistance of Dr. M. J. Bush, were developing new teaching aids and research tools through use of computers. Funds for a stand-alone computer were also provided by DAEM to facilitate the computational aspects of the study.
- In 1978-79 Dr. Marcelo Epstein was invited to supervise, content specialist and consultant for a film and video tape entitled *Women in Engineering*, produced by Communications Media at The U of C. The film was received enthusiastically by both the student body and the public. It was shown on commercial and educational networks across Canada and was used in high schools to inform female students of the attractions and advantages of engineering as a profession.



Plate 6.75 Miss Leanne MacKenzie, secretary in the Department, is displaying a model from the Rube Goldberg Contest held Feb. 1987. The competition initiated in 1976 by Prof. Ernst Edel and taken over by Prof. G. Walker in 1980 was an annual highlight for seniors in Mechanical Engineering until 1991. Feb. 1987.

the research activities and studies of 55 graduate students, including 27 PhD, 25 MSc and 3 MEng candidates, an activity which he considers to be his most important contribution. He also had 40 co-workers, 24 PhD's and research associates, 8 visiting scientists and 8 research assistants involved in his research projects.

Prof. Karim was successful in obtaining external funding to help support such a large group of students and co-workers. For example, he obtained \$234,612 (1977-89) from AOSTRA for research on the combustion of tar sand particles in hot gaseous streams and on ignition, flammability and quenching within a packed bed of solids (see Plates 6.16, 6.45 and 6.78). His studies on fire spread through stratified fuel-air mixtures were supported by Imperial Oil Ltd. (\$19,000: 1978-80) and by Alberta Occupational Health & Safety's Heritage Grants (\$134,000: 1986-88). Funds for his work on efficient utilization of low heating value fuels were provided by A/C-ERRF, while a series of NSERC Strategic Grants, totaling \$280,000 (1981-91), together with an NSERC major equipment grant (\$93,255: 1987, with others) made possible various studies on combustion and on the efficiency of internal combustion engines.

- While involved in the vertical axis wind turbine project (see Plate 6.65), Dr. J. A. C. Kentfield proposed a novel horizontal axis, self erect



a. Dr. M. G. Kibrya is proudly displaying his improved version of the Olympic torch. Dec. 24, 1987.

Plate 6.76 Shortly before Christmas, 1987, Dr. M. G. Kibrya, Assoc. Prof., assisted with his former supervisor, Prof. Karim, was asked to make modifications to the Olympic torch to increase its flame stability in wind and enhance the flame's color. The redesigned torch, using a new fuel mixture with special additives, was tested on Dec. 27-28, 1987 during the shooting of the final TV advertising film for the Olympic Torch Relay near Bragg Creek. Dr. Kibrya was present to monitor the performance of the torch in this field test.



b. The torch flame was enhanced with a more intense purple to improve its video color image.

- Dr. G. A. Karim continued to be the front runner in terms of number of graduate students and co-workers supervised. During the period 1968-91 he guided

fixed pitch turbine with delta wing type blades and direct drive variable stroke water pumping mechanism. In collaboration with Abacus Engineering Ltd. (renamed Abax Energy Services Ltd.) a 16 m rotor diameter wind turbine was designed and constructed using funds totaling \$485 000 obtained by Abax from the Province and A/C-ERF. 1981-84. One of his designs was adopted by Dutch Industries Ltd. Regina who constructed a full-scale prototype of his gearless delta wing-type per meter bladed water pumping wind turbine (see Plate 6.81 and the Silver Anniversary Section in this Chapter).

A second main research area for John Kentfield is the pressure-gain pulse combustor and its use in gas turbines. He was consultant to Battelle Columbus Laboratories, Ohio in their pulse combustion systems research, 1976-1986, and to Aigas Research Ltd., Calgary, who provided \$40 000 for a hand held pulse combustor heater project, 1978-81. In collaboration with Abax, he prepared a proposal for a study of the application of pulse combustion to water gas drives, which resulted in a \$85 000 grant from the Department of Energy, Association of Canada, 1981-82. In 1984, he and his students ran a successful demonstration of the world's first gas turbine engine



Plate 6.80: John Kentfield, in collaboration with Abax Energy Services Ltd., designed and constructed a 16 m rotor diameter wind turbine. The turbine was built in Regina, Saskatchewan, and is now on display at the Canadian Museum of Science and Technology in Ottawa. The turbine was built using funds totaling \$485 000 obtained by Abax from the Province and A/C-ERF. 1981-84. One of his designs was adopted by Dutch Industries Ltd. Regina who constructed a full-scale prototype of his gearless delta wing-type per meter bladed water pumping wind turbine (see Plate 6.81 and the Silver Anniversary Section in this Chapter).

powered with a pressure-gain pulse combustor, achieving a 15% increase in power and a similar reduction in fuel consumption.

- In the spring of 1985, Drs. A.G. Dr. J.P. Vermeulen obtained a \$42,000 equipment donation from Brierley & Kiefer, Canada, specialists in acoustic and vibration measurements. The equipment was

were handled by Mr. Tom Ho, their Western Regional Manager. With matching funds from the Province and a \$63 000 contribution from the Department, the duo was able to acquire \$0.55 million worth of sophisticated acoustics and structural dynamics research equipment for studies in vibrations, noise control and machine health monitoring. The equipment was housed in the newly completed Vibrations and Acoustics Research Laboratory (see Plate 6.82).

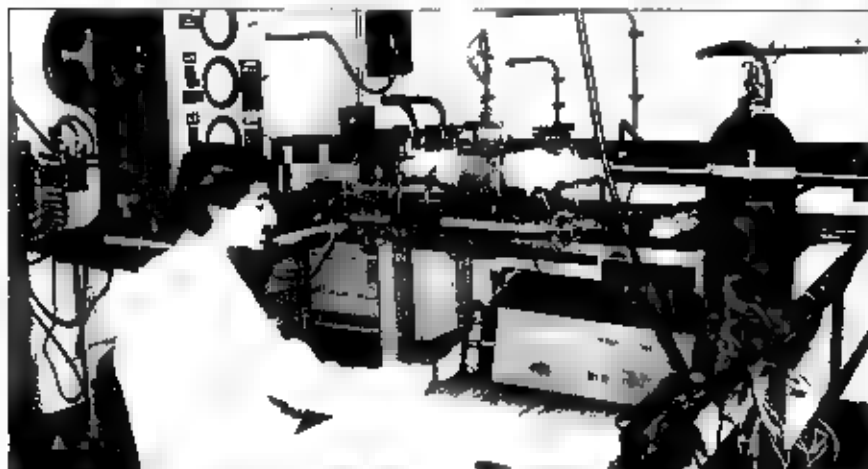


Plate 6.81: John Kentfield, in collaboration with Abax Energy Services Ltd., designed and constructed a 16 m rotor diameter wind turbine. The turbine was built in Regina, Saskatchewan, and is now on display at the Canadian Museum of Science and Technology in Ottawa. The turbine was built using funds totaling \$485 000 obtained by Abax from the Province and A/C-ERF. 1981-84. One of his designs was adopted by Dutch Industries Ltd. Regina who constructed a full-scale prototype of his gearless delta wing-type per meter bladed water pumping wind turbine (see Plate 6.81 and the Silver Anniversary Section in this Chapter).

- After being in the Department for 25 years, Dr. Ida Wierzbna was appointed Assoc. Prof. on Sept. 1, 1982, thereby becoming the first female academic at such rank in engineering and only the second woman full-time appointee in Mechanical Engineering. With a graduate student, she began to develop her own research projects dealing with combustion in relation to safety and fuel utilization, including alternative gaseous fuels. Within a year she obtained external funding for her studies and soon had established her group, producing significant research results which she published and/or presented at conferences. Her outstanding contributions were recognized by promotion on July 1, 1987, when she also

became the first female full professor in the Faculty

- Within 2 years after his appointment in 1981 Dr W J D Shaw established his materials research facilities, supervised 8 graduate students and found over \$50,000 p.a. research support from industry and governmental agencies. He was also awarded 2 NSERC major equipment grants, totaling \$84,300 one (\$68,500) with Dr W E. White for a scanning electron microscope. He soon became the Department's most successful academic in terms of obtaining industrial funding.

Some of his first projects included a 3 year \$22,500 study on fracture toughness of steels in a sour gas environment for Imperial Oil Ltd and an investigation of creep of stainless steels funded by EMP (1982-83 \$15,000). A 3 year \$45,000 grant from AERT supported work on corrosion of casing materials in natural waters from across Alberta (1983-85) while Petro Canada funded a project on screening of corrosion inhibitors for well casing materials (1984-85 \$50,900). A project evaluating the effects of cycling of wet and dry conditions on the interlamellar shear in high

strength composite materials used in the CF 18 fighter plane was supported by a \$100,000 contract 1984-85 with the Defence Research Establishment Pacific DREP. The Alberta Coal Board provided \$94,400 in 1986-87 for corrosion studies on various steels in coal-gasification environments (see also Plates 2.10 and 6.11).

- Dr Graham (Joe) Walker refers to himself as a *student of Stirling technology*, since 1957 the year he finished a BSc thesis on regenerative thermal machines at Kings College Newcastle Upon Tyne. By the time he completed his doctoral dissertation on Stirling engines in 1962 he had become an ardent champion of Stirling cycle machines. He soon also became one of the leading authorities on Stirling technology and its application to power sys-

tems, refrigeration and heat pumps. As such his consulting services were in high demand. For example in 1984 he took a 1 year unpaid leave to accept the position of Director of Cryogenic Research and Development at the Western Research Centre of General Pneumatics Corp. Scottsdale Arizona, where he was responsible for the development of miniature cryocoolers used in infrared night vision and missile guidance systems in helium and hydrogen liquefiers for superconducting magnetic resonance imaging (MRI) equipment and for storage vessels proposed for space use in the *Star Wars* programme.

He also made available his expertise through invited lectures, seminars, workshops and short courses. One of the most successful continuing education undertakings he has been involved in is the series of annual 5 day short course offerings at the University of California, Los Angeles, initiated in 1974 treating such topics as Stirling Engines, Cryocoolers, and Heat Exchangers, courses he also offered at universities, research institutes and industrial organizations in the U.S., the UK, Italy, Yugoslavia and Brazil. Invited lecture tours to Japan, Hong Kong, China, and Australia provided additional opportunities for disseminating information on Stirling technology.

In addition to lecturing and presenting papers and keynote addresses around the world, he was also one of the main contributors to the rapidly growing technical literature on Stirling technology. He is the author of 9 books, 3 of which are in press (in 1993) and/or have one or more co-authors (see Table 6.3). His text on *Stirling Engines*, published by Oxford University Press in 1980 and translated into Russian and Chinese, is considered to be the best compilation of basic and



C.T. Reader L. Bauwens P. Gi X. Mao P. Rogers

Plate 6.79 The fourth Head of Mechanical Engineering and some of the academic staff appointees 1989-99.

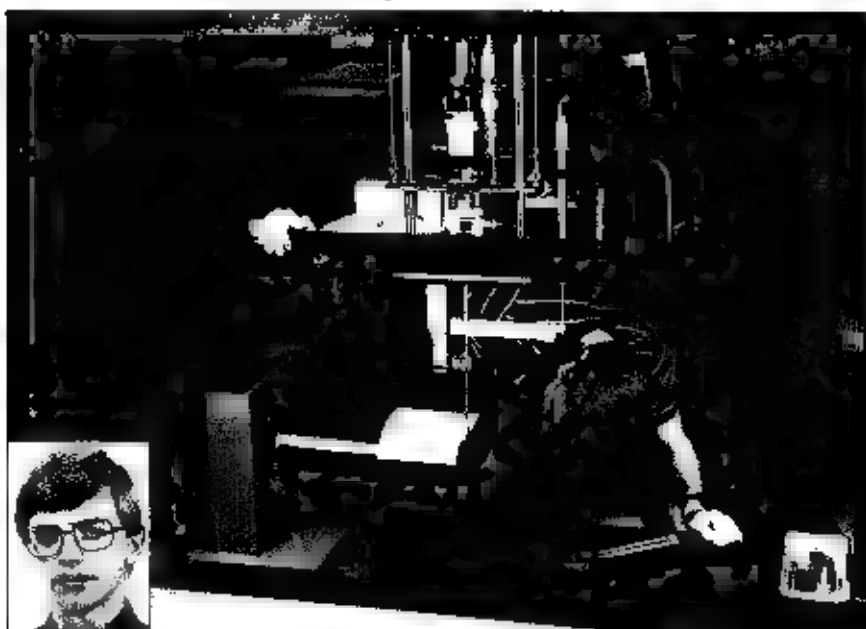


Plate 6.80 PhD candidate Jaroslaw Nowinka (inset) is examining the deformation patterns of a cylindrical anti-swept aluminium tube subjected to a vertical concentrated load applied in its plane of symmetry and at its free edge. A 100 N load cell, an X-Y-ZT and an HP single-pen plotter were used to obtain load deflection plots of the shells undergoing large elasto-plastic deformations and buckling. The 20 mm diameter shells were 50 mm long, and were made of 0.3 mm thick aluminium alloy sheets. Deflections of the size of the tube diameter were obtained at ultimate loads. The project was supervised by Prof S.A. Lukaszewicz and funded from his grants (winter 1989).

applied materials on the subject at the time. His own research work on polymers, initiated in 1983, is the principal reference on the subject and is stated to be one of the most widely used in the field.

Jim Wagner, a many faceted actor, writer, director, and producer, died of cancer on May 14, 1993. He was 64. He was born in New York City and moved to Los Angeles in the 1960s. He was a member of the Writers Guild of America and the Directors Guild of America. He was married to actress Jane Fonda. He is survived by his wife and two children.

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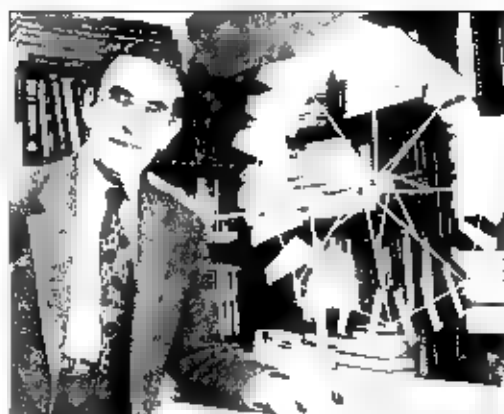
1 1987 to work on the
Feasibility Study

The Study was carried out during the first 4 months of 1987 by a Canadian consulting team consisting of academic advisors, headed by Dr. Vermeulen and EdJ consult staff Peter Vermeu-

was a response for the first 45 of immigrants and was assisted by Mrs. G. J. Burg and R. A. Steiner from Electric Engineering Prof. A. A. T. from the Department and Dr. A. M. von Gratz from Civil Engineering. A member of the Faculty visited Nepal with his family 4 weeks during the first 4 weeks period.

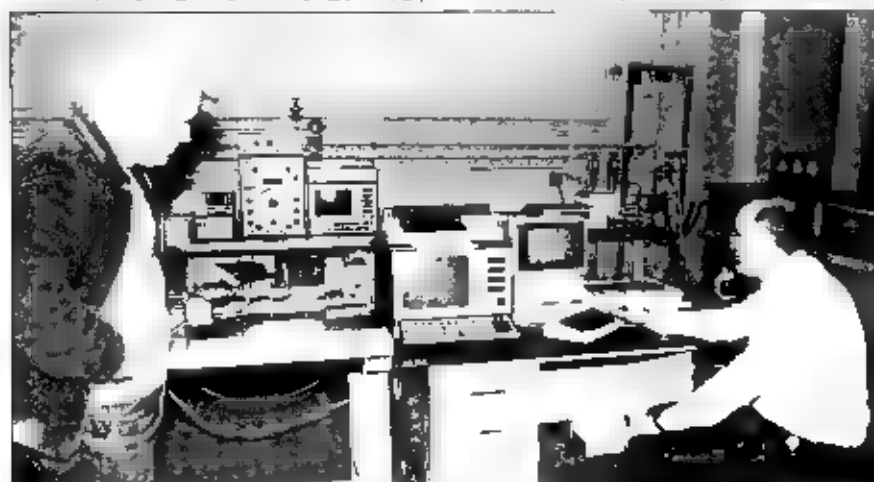
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- When Dr. R. D. Rowe transferred from the Department of Chemical Engineering on July 1, 1981, his duties were assumed by Dr. C. T. Yeh.

[illegible]

his work with the environmental dynamics community and in industry (see Chapters 1 and Plates 3-4a and 6-39a). Recognition came in the form of a Fellowship appointment and invitations to speak at international and workshop. For example, he was invited in on an advisory panel and worked with the Federal Oceans DFO and worked out a study of the Bering Sea by the US-ORIG-Canada group with American Healy. He was invited to participate with the US, Canada, and Norway to participate in the Subsea Contamination Workshop in Oslo, Norway, Oct. 1985. Also by invitation he was he participated in a workshop on Deep-sea Complex Terrains held in Keystone Colorado May 1983.

Richard Rowe spent his sabbatical leave July-Dec 1982 at the Institute of Oceanographic Sciences, Sydney, Vancouver Island, working with the Frozen Sea Research Group to determine that his work on plumes from stacks and his 2-layer flow work had find applications in the study of a number of important marine problems. Consequently he initiated 2 very successful studies: one on the behaviour of bubble formation and plumes as they relate to sea-ice, with blow-outs and a jet of air in subsea flows around offshore platforms. Funding for these two projects, totaling over \$100 000, came from a number of DFO/DSS contracts, grants from Environment Canada, AERT and Amoco Canada.

[illegible]

Ltd. (see Plate 6.77) in addition to annual NSERC operating grants during the period 1982-1991.

- On Jan. 1, 1981 Dr S.A. Lukasiewicz from the Technical University of Warsaw arrived to spend his leave as Visiting Professor in the Department. With more than 20 years of academic experience and as the author of numerous publications and a definitive monograph on *Local Loads in Plates and Shells*, his contributions and name were known to many in the applied mechanics community around the globe, especially after the English translation of his book appeared in 1979. During the summer of 1982 he was selected as one of 5 new appointees. His appointment as Professor, the Department's first non-administrative initial term contract at the full professorial level, was a clear recognition of his outstanding achievements.

With his experience and after 20 months in the Department, Stanislaw Lukasiewicz had little difficulty in settling into his new environment. Within a couple of years he had secured external funding to help support graduate students and a research associate. His early projects included studies on the collapse mechanism of cylindrical flatheads and the large elasto-plastic deformation and buckling of thin shells subjected to concentrated loads. His work on membranes led to a new concept, *the pneumatic pipe*, details of which were pub-



Plate 6.83 Prof. Józef Vinogradov seated is shown with some of his present and former students involved in his major research on fluid flow with nonlinear, hysteretic boundaries and with the dynamics of flow of the rate systems of bodies, soil during the behaviour of granular materials and the motion of ice floes, rivers and their interaction with structures, bridges and piers. The studies also involved some of his coworkers, as Messrs. S. Antkowiak and Y. Bakharuk, his first M.Sc. and his research associates and Ph.D. students, respectively as well as Dr. Ivan Petrovich, Research Assistant, Plate 6.84, and Dr. R. P. Chen, Dr. Y. K. Sun, Dr. X. Huang, O. J. Vukobratovic, Mr. W. A. Springer and Dr. P. Wierzbicki. Dec. 1, 1993.

lished and presented at international conferences including an invited lecture at the ASS symposium in Bangalore, India. His second project sparked even wider interest and resulted in keynote and invited lectures at high-profiled international conferences in Rio de Janeiro, Brazil, Bombay, India, Barcelona, Spain and Valparaíso, Chile. Starting in 1984-85 he developed a *laser stress analyser*, LASTRAN, a totally automatic, computer-controlled photoelastic stress analyser for which he holds patents in Canada, the U.S. and Poland. He was invited to present lectures on and

or demonstrate his invention at various conferences and exhibitions including a High Technology Exhibition in Edmonton, Sept. 1989, an Int. Congress and Exhibition on Sensor and Systems Technology in Nürnberg, May 1991, and a Photomechanics and Speckle Metrology Congress in San Diego, July 1991.

A spin off of his LASTRAN is a matrix filtering technique with accom-

panying algorithm, used in correcting and improving results from experimental data, a technique received enthusiastically by the numerical analysis and experimental mechanics community.

A significant contribution grew out of his continuous involvement with local industry where he helped to develop programmes for the design and evaluation of pumping systems used in reservoir simulation. This work led to an efficient computer model and code for the dynamic behaviour of sucker rod strings in inclined wells, TOTAL of France purchased his model and code and are using it in their worldwide reservoir studies. Rewarding also was the granting of a Canadian patent for his *universal expansion joint*, patented and used in Poland for over 2 decades, in providing trouble-free connections for large industrial pipe-networks.

- Prof. P.G. Glickner was selected as recipient of the 1993 CANCAM Award, 'presented in recognition of outstanding contributions to the area of Applied Mechanics at CANCAM '93 in Kingston, Ontario, June 2, 1993 (see Plate 6.84).

Additional highlights and outstanding achievements by staff and students as well as departmental administrative aid personnel history and statistics are indicated in Tables 6.1-6.4 at the end of the Chapter.



Plate 6.84 Dr. P.G. Glickner receiving the 1993 CANCAM Award from Mr. J. A. G. Glickner, President of the Canadian Association of Mechanical Engineers (CAME), in a formal ceremony. The presentation was by Dr. B. Glickner, President of the CAME, and Dr. Glickner was also a member of the CAME. The award was presented by the Central Committee for ANCAM, June 1, 1993.

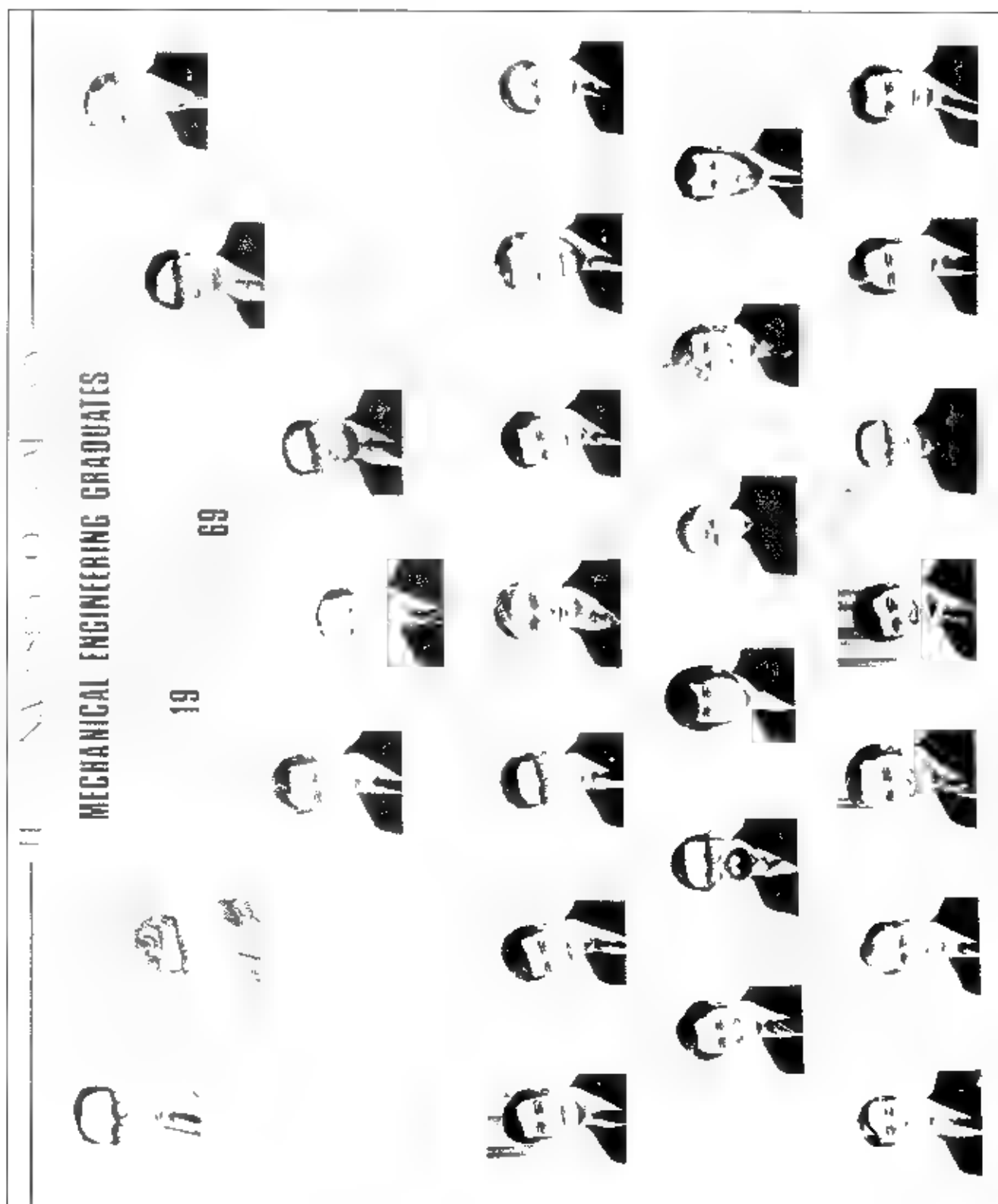


Plate 6.85 - The first Mechanical Engineering graduating class — May 1969

Table 6.1 STAFF AND ADMINISTRATION 1990-91
DEPARTMENT OF MECHANICAL ENGINEERING

| | | | |
|--|--|--|---------------------|
| HEAD: Dr Reader G.T
Secretary: Mrs. Goss, K.M. (till 92.01.15) | | ACADEMIC STAFF | |
| ASSOCIATE HEAD: Dr Norrie D.H.
(Head C.M. Div) | | Dr Bauwens, L. | Dr Mikulicik F.C. |
| ASSOCIATE HEAD: Dr Rowe R.D.
(Graduate Studies) | | Dr Chowdhury K.L. | Dr Neme D.H. |
| SECRETARIAL STAFF | | Dr deKrasinski, J.S. (Emerit) | Dr Reader G.T. |
| Ms. Banach, L.J. (since 91.06.22) | Ms. Kuervers, L.J. (since 90.09.01) | Dr Dodge, A.G. (Emerit) | Dr Rogers, P. |
| Mrs. Berry M.B. | Mrs. Lacombe, A. (till 90.08.31) | Dr Epstein, M. | Dr Rowe R.D. |
| Mrs. Calverley C.E. | Mrs. Parkinson, B. (89.11.20 - 90.08.17) | Dr Fauvel O.R. | Dr Shaw W.J.D. |
| Miss Clark, M. (till 90.08.24) | Ms. Pawlowski, J. (90.10.15-91.08.16) | Dr Glockner P.G. | Dr Singh, M.C. |
| Mrs. Evans, P.J. | Mrs. Undseth, K.A. | Dr Gu, P. | Prof. Torvi, A.A. |
| Ms. Kriger S.E. (91.09.03 - 91.11.19) | | Dr Kahn, G.A. | Dr Vermeulen, P.J. |
| | | Dr Kentfield, J.A.C. | Dr Vinogradov, O.G. |
| | | Dr Lukasiewicz, S.A. | Dr Walker, G. |
| | | Dr Mao, X. | Dr Wierzbka, I. |
| TECHNICAL STAFF | | VISITING PROFESSORS, RESEARCH ASSOCIATES/ ASSISTANTS, P.D.F's AND SESSIONAL INSTRUCTORS | |
| Supervisor: Mr. Bechtold, R.L. | | Dr Al-Himyari, T.J. | Mr. Jones, B. |
| Director C.M. Lab: Mr. Wilkinson, J.B. | | Dr Badr, O. | Mr. Ni Chao-Fang |
| Manager Computer System: Stephens, B.W. | | Mr. Bloor, J. | Dr Pivovarov |
| Technicians: | | Mr. Chun, Lin X. | Dr Ramesh, V. |
| Mr. Daley, B.S. | Mr. Moehrl, A.O. | Miss Chin, M. | Mr. Richardson, J. |
| Mr. East, G. | Mr. Rowell, R. (till 90.03.28) | Dr Czapulowicz, E. | Mr. Silovsky, K. |
| Mr. Ferguson, B.R. (since 90.06.17) | Mr. Sanders, B.R. | Dr El-Rahman, M.A. | Dr Stanuszek, M. |
| Mr. Gustafson, R.W. | Mr. Vogt, N. | Lt. Hawley, G. | Mr. Wang, Zh. |
| Mr. Johnson, M.K. | | Dr Hanafi, A. | Mr. Zhang, Ch.-Y. |
| | | Mr. Jeje, A.B. | Dr. Zu, Y.-K. |
| | | Mr. Jensen, L. | |

Table 6.2 TIME LINE OF ADMINISTRATION - 1966-1991
DEPARTMENT OF MECHANICAL ENGINEERING

| Year | Head | Departmental Secretary | Associate Head(s)
Head of Division | Technical Supervisor |
|------|---|------------------------------------|---------------------------------------|----------------------------------|
| 1966 | D.H. Norrie
(07.01.66) | B. Noreen
(06.14) | | — |
| 1967 | D.H. Norrie | B. Noreen | — | J. Holdsworth |
| 1970 | A.G. Dodge
Acting
(07.01.70) | F.S. Howard
(06.23) | — | J. Holdsworth |
| 1971 | G.A. Kahn
Acting
(08.06.71) | F.S. Howard | | J. Holdsworth |
| 1972 | A.G. Dodge
(09.01.72) | F.S. Howard | | J. Holdsworth |
| 1974 | A.G. Dodge | R. Hittle
(06.01) | | J. Holdsworth |
| 1976 | P.G. Glockner
(07.01.76) | B.A. Maylor
76.10.01 - 78.08.01 | | J. Holdsworth |
| 1978 | P.G. Glockner | M. van Koll
(08.07.78) | | J. Holdsworth |
| 1980 | P.G. Glockner | M. van Koll | — | W.A. Anson
(07.01.80) |
| 1981 | A.G. Dodge
Acting
(07.01.81) | M. van Koll | | W.A. Anson |
| 1982 | P.G. Glockner | M. van Koll | | W.A. Anson |
| 1985 | P.G. Glockner
(07.01.85) | G. Jones
10.01 | | W.A. Anson |
| 1986 | P.G. Glockner | K.M. McCarthy
(04.21) | — | W.A. Anson |
| 1987 | P.G. Glockner
A.G. Dodge
Acting
(07.01.87) | K.M. Goss | | R.L. Bechtold
(06.01.87) |
| 1988 | G.T. Reader
(07.01.88) | K.M. Goss | — | R.L. Bechtold |
| 1989 | G.T. Reader | K.M. Goss | | R.L. Bechtold
J.B. Wilkinson† |
| 1990 | G.T. Reader | K.M. Goss | D.H. Norrie
10.01 | R.L. Bechtold |
| 1991 | G.T. Reader | M.B. Berry | R.D. Rowe
10.01 | J.B. Wilkinson† |

* A. Cahill (78-08.01); M. Wardle (78.11.15-); P. Appleton (79.03.12-); J. Hinchcliffe (79.05.15-)

† Technical Director of CIM Laboratories

Table 6.3 STUDENT AND STAFF AWARDS, PRIZES AND ACHIEVEMENTS
DEPARTMENT OF MECHANICAL ENGINEERING, 1966-1991

I Undergraduate Scholarship, Medal and Prize Winners

(a) Association of Professional Engineers, Geologists and Geophysicists of Alberta Gold Medal

| | | | | | |
|-----------------------|---------------------|----------------|----------------------|--------------------|-------------------------|
| 1969 Thompson, H.R. | 1974 Verne, A.H. | 1978 Siu, L.W. | 1982 Crawley, W.D. | 1986 Weiss, M.H. | 1990 Saponja, J.C. |
| 1970 Howes, B.C. | 1975 Zacher, B.J. | 1979 Fan, Y.C. | 1983 Vermeulen, S.O. | 1987 Giliens, S.D. | 1991 Wilton-Clark, H.W. |
| 1971 Danilowich, M.S. | 1976 Thirsk, R.B. | 1980 Pow, L.E. | 1984 Urmacher, D.J. | 1988 Wierzbna, A. | 1992 Sanchez |
| 1972 Dumka, D.N.H. | 1977 Laustsen, D.B. | 1981 May, K.B. | 1985 Daniel, S.D. | 1989 Price, G.R. | 1993 Lawrence, D.M. |
| 1973 Kovacs, J.R. | | | | | |

(b) Alberta Heritage (Louise McKinney) Scholarship

| | | | | | |
|--------------------|-----------------------|-----------------------|----------------------|-------------------|---------------------|
| 1981 Brown, A.P. | 1982 Carroll, A.W. 2x | 1983 Volcko, M.D. 3x | 1985 Goodchild, J.P. | 1988 Engler, K.S. | 1991 Telang, L.V. |
| Crawley, W.D. | Retzer, H.O. 3x | 1984 Feighan, P.J. 3x | Hindie, S.L. 2x | Price, G.R. | 1991 Yee, B.O.S. 2x |
| Kula, L.W. Jr. 2x* | Derick, S.D. 2x | Gillins, S.D. | Smith, C.M. | 1989 Sawa, M.R. | 1992 Koren, T. |
| Vermeulen, S.O. 2x | deVillafagne, R.P. 2x | Stewart, J.N. | 1987 Born, M.W. | Stevenson, A.W. | Oliver, R.D. |
| Zachary, J.E. | 1983 MacDonald, R.H. | 1985 Blair, K.A. | 1987 Wierzbna, A. | | 1993 Dumont, M.D. |

(c) The Transalta Utilities (Calgary Power) Memorial Scholarship

| | | | | | |
|---------------------|--------------------|----------------------|-----------------------|----------------------|---------------------|
| 1977 Kornfeld, G.L. | 1978 Cornish, R.G. | 1980 Kula, L.W., Jr. | 1984 Sjöberg, B.D. | 1987 Chiu, J. | 1989 Rossiter, D.M. |
| Pow, L.E. | Olmyk, J.A. | 1982 Schopp, J. | 1985 Lundberg, G. | Peterson, B.D. | 1990 Corti, S. |
| Schramm, R.C. | Trick, M.D. | 1983 Weiss, M.H. | 1986 Lee, J. | 1988 Sanderson, D.M. | Webb, T.D. |
| Wong, J.T.Y. | 1979 Swystun, R.L. | 1984 Goldsmith, P.B. | 1986 Mainwaring, C.R. | 1989 Bergman, J.W. | 1991 Chow, L. |

(d) Canadian-Montana Gas Co. Ltd. Scholarship

| | | | | | |
|-----------------------|-----------------------|-------------------|--------------------|-------------------|----------------------|
| 1968 Danilowich, M.S. | 1971 MacKenzie, D.H. | 1976 Siu, L.W. | 1980 Mikkelsen, R. | 1986 Blair, K.A. | 1991 Leeds, B.M. |
| Perschon, F.H. | 1972 Cheng, K.M. | 1977 Poon, Y.C. | 1981 Kostuk, L.W. | 1988 Gibson, S.W. | 1992 Machacek, T.J. |
| 1969 Dumka, D.N.H. | 1973 Christiansen, S. | 1978 Pelzer, D.A. | 1982 Orr, A.C. | 1990 Lysang, D.G. | 1993 Mukherjee, J.S. |
| 1970 Patterson, M.G. | 1975 Schlichter, H.G. | 1979 Trick, M.D. | 1983 Peters, K.E. | | |

(e) Chevron Canada Resources (Chevron Standard) Ltd. Scholarship in Engineering

| | | | | | |
|---------------------|---------------------|-------------------|-------------------|--------------------------|-------------------|
| 1968 Thompson, H.R. | 1983 Obreiter, R.P. | 1987 Hindie, S.L. | 1988 Hugo, R. | 1989 Gibson, S.W. | 1992 Hinger, M.J. |
| 1971 Dumka, D.N.H. | 1984 Schopp, J. | Lundberg, G. | 1991 Screen, K.C. | 1991 Sanchez, I. | Wilson, T.E. |
| 1973 Zacher, B.J. | 1985 Ciurylski, G. | 1987 Smith, C.M. | 1989 Born, M.W. | 1991 vanderVliet, A.D.E. | 1993 Koren, T. |
| 1983 Clausner, R.M. | 1986 Klempner, M.S. | | | | |

(f) Petroleum Society of C.M., Calgary Section Scholarship

| | | | | | |
|---------------------|---------------------|-------------------|---------------------|-----------------------|------------------|
| 1977 Lam, H.T. | 1981 Cole, G.K. | 1985 Torvi, D.A. | 1988 Eckstein, M.W. | 1990 Bergman, J.W. 2x | 1990 Woo, D. |
| 1978 Kornfeld, G.L. | 1982 Homer, B.J. | 1986 Wierzbna, A. | 1990 Flanagan, C.D. | Nodwell, K.A. 2x | 1993 Bergman, E. |
| 1979 Schmalz, R.A. | 1983 Harrison, M.K. | 1987 Lee, J. | 1989 Engler, K.S. | Williams, D.N. | Miller, J.E. |
| 1980 Crawley, W.D. | 1984 Visser, K.D. | Wilson, D.K. | | | |

(g) Dr. Alex Petrunik Memorial Scholarship

| | | |
|-------------------|--------------------|----------------------|
| 1970 Clarke, A.A. | 1982 Geppert, N.S. | 1988 Vadnai, L.J. |
| 1972 Zacher, B.J. | 1984 Danyluk, T.L. | 1989 Collins, R.D.G. |
| 1975 Klaver, H.H. | 1985 Lam, K.F.K. | 1990 Claville, E.J. |
| 1976 Colvin, K.L. | 1986 Wilcox, L.J. | 1991 Lysang, D.G. |
| 1978 Abday, D.M. | 1987 Tom, J.C.K. | 1992 Chow, L. |

(h) Nabors Drilling Ltd. Scholarship

| | | |
|--------------------|-------------------------|--------------------|
| 1978 Lam, H.T. | 1983 Lisoski, D.L. | 1988 Hindie, S.L. |
| 1979 Pow, M.J. | 1984 LeBlanc, A.W. | 1989 Saponja, J.C. |
| 1980 Unruh, L.H. | 1985 deVillafagne, R.P. | 1990 Milner, B.A. |
| 1981 Mikkelsen, R. | 1986 Goodchild, J.P. | 1991 Wilson, T.E. |
| 1982 Vnclink, H.J. | 1987 Nikiforuk, C.F. | 1992 Corti, S. |

(i) Dominion Oilfields Supply Co. Ltd. Bursary

| | | |
|----------------------|----------------------|--------------------|
| 1976 Theriault, R.J. | 1981 Fehr, D.D. | 1985 Stamer, A.J. |
| 1977 Kohut, D.R. | 1982 Staniland, J.E. | 1986 Pollard, P.R. |
| 1978 Pow, M.J. | 1983 Shopperly, C.K. | 1987 Gee, S.Y. |
| 1979 Burns, H.C. | 1984 Dye, D.G. | 1988 Dick, K.E. |

(j) Phillips Cabies Ltd. Bursary

| | |
|--------------------|--------------------|
| 1983 Chung, T.T. | 1985 Stewart, J.N. |
| 1984 Butt, A.M. | 1986 Kraft, C.L. |
| Sikora, R.P. | Lundberg, G. |
| 1985 Snedden, C.M. | |

(k) Canadian Western Natural Gas (The Gas) Co. Undergraduate Scholarship in Engineering

| | | |
|---------------------|-------------------|----------------------|
| 1968 Howes, B.C. | 1971 Hult, V.A. | 1989 Sanderson, D.M. |
| Rogers, R.J. | Ibbotson, D.J. | Thong, C.Y. |
| 1969 Perschon, F.H. | 1986 Currie, I.R. | 1992 Cheng, T.Y. |

(l) Norcen Energy Ltd. Scholarship in Engineering

| | | |
|---------------------|----------------------|-------------------|
| 1988 Born, M.W. | 1990 Victor, A.J. 2x | 1992 Waters, T.J. |
| 1989 Peterson, B.D. | 1991 Galinsky, G. | 1993 Hos, W.R.S. |
| Schobier, C.E. | Williams, D.N. | Nienwandt, J.M. |
| vanderVliet, A.D.E. | Budd, M.D. | Yee, B.O.S. |
| Sadler, A.M. | 1992 Doan, D.K.H. | |

(m) Shell Canada Resources Ltd. Centennial Scholarship

| | | |
|---------------------|---------------------|-------------------|
| 1976 Laustsen, D.B. | 1981 Lee, J. | 1985 Weiss, M.H. |
| 1977 Siu, L.W. | 1982 Zachary, J.E. | 1991 Corti, S. |
| 1978 Poon, Y.C. | 1983 Urmacher, D.J. | Urnsbach, D.O. 2x |
| 1979 May, K.B. 2x | 1984 Carroll, A.W. | |

(n) William Lemond Hamilton Bursary

| | | |
|-----------------------|---------------------|----------------------|
| 1984 Forgach, T.W. 2x | 1989 Hufema, S.A. | 1992 Mukherjee, J.S. |
| 1986 Frank, J. | 1990 Corner, C.T. | 1993 Visser, M.D. |
| 1987 Kim, C.Y. | Dedora, G.T. | 1998 Pilstra, W.C. |
| 1989 Bell, M.E. | 1991 deCuyper, M.E. | |

(o) Robert B. Paugh Memorial Bursary

| | |
|---------------------|-----------------------|
| 1966 Thompson, H.R. | 1978 Sondergard, M.A. |
| 1976 Thom, R.M. | 1980 Obreiter, R.P. |
| 1977 Brown, D.C. | 1986 Gee, T.Y. |

(o) Canadian Occidental Petroleum Ltd. Bursary

| | |
|--------------------|---------------------|
| 1983 Geppert, N.S. | 1988 Lee, J. |
| 1985 Murdoch, K.R. | 1990 Barge, J.R. |
| 1987 Mueller, J.A. | 1991 Claville, E.J. |

(p) Amoco Canada Petroleum Co. Ltd. Scholarship

| | |
|--------------------|------------------|
| 1977 Sidley, P. | 1991 Heki, K.S. |
| 1981 Stretka, R.P. | 1993 Wells, B.G. |
| 1982 Nagy, E.J. | Smit, H.J. |
| 1990 Sawa, M.R. | |

* nx = n years

I. Undergraduate Scholarship, Medal and Prize Winners (cont'd)

| (r) Archibald Wayne Dingman Memorial Scholarship | | | | | | (s) Viscount Bennett Scholarship | | | | | |
|---|---|-----------------------|---------------------|------------------------|----------------------|--|---|------------------------|----------------------|------------------------|----------------------|
| 1981 Jensen, L.G. | 1984 Perrott, D.B. | 1986 Yurkowski, T.K. | 1991 Lawrence, D.M. | 1967 Howes, B.C. | 1980 Kennell, J. | 1967 Howes, B.C. | 1980 Kennell, J. | 1967 Howes, B.C. | 1980 Kennell, J. | 1967 Howes, B.C. | 1980 Kennell, J. |
| 1983 Reitzer, H.O. | 1985 Laing, P.E. | 1989 Sanderson, D.M. | 1991 Rossiter, D.M. | 1969 Howes, B.C. | 1985 Ross, B.D. | 1969 Howes, B.C. | 1985 Ross, B.D. | 1969 Howes, B.C. | 1985 Ross, B.D. | 1969 Howes, B.C. | 1985 Ross, B.D. |
| 1985 Goldsmith, P.B. | 1986 Sheppy, C.G. | 1990 Leeds, B.M. | | 1969 Rogers, J.R. | 1988 Corner, C.T. | 1969 Rogers, J.R. | 1988 Corner, C.T. | 1969 Rogers, J.R. | 1988 Corner, C.T. | 1969 Rogers, J.R. | 1988 Corner, C.T. |
| (t) Champlin Canada Ltd Scholarship | | | | | | (v) Canada Scholarship | | | | | |
| 1979 Cornish, R.G. | 1982 Brown, A.P. | 1985 Butt, A.M. | 1991 Sanchez, I. | 1990 Bergman, J.W. 2x* | 1990 Sawa, M.R. 2x | 1990 Bergman, J.W. 2x* | 1990 Sawa, M.R. 2x | 1990 Bergman, J.W. 2x* | 1990 Sawa, M.R. 2x | 1990 Bergman, J.W. 2x* | 1990 Sawa, M.R. 2x |
| Trick, M.D. | 1985 Gittins, S.D. | 1988 McMurray, K.W. | 1992 Lawrence, D.M. | Robinson, A.R. | 1991 Denzel, R.W. 2x | Robinson, A.R. | 1991 Denzel, R.W. 2x | Robinson, A.R. | 1991 Denzel, R.W. 2x | Robinson, A.R. | 1991 Denzel, R.W. 2x |
| 1981 Laurensen, C.J. | 1986 Gittins, S.D. | 1990 Sanderson, D.M. | 1993 Telang, L.V. | Woo, D. | Telang, L.V. 2x | Woo, D. | Telang, L.V. 2x | Woo, D. | Telang, L.V. 2x | Woo, D. | Telang, L.V. 2x |
| | | | | Yee, B.O.S. 3x | 1993 Dumont, M.D. | Yee, B.O.S. 3x | 1993 Dumont, M.D. | Yee, B.O.S. 3x | 1993 Dumont, M.D. | Yee, B.O.S. 3x | 1993 Dumont, M.D. |
| (w) Canada Cities Service Ltd Bursary | | | | | | (y) Cactus Drilling Comp. Ltd Bursary | | | | | |
| 1971 Bates, G.F. | 1980 Cornish, R.G. | 1977 Petzer, D.A. | 1983 Cellars, B.W. | 1975 Christiansen, S. | 1984 Rattan, D.S. | 1975 Christiansen, S. | 1984 Rattan, D.S. | 1975 Christiansen, S. | 1984 Rattan, D.S. | 1975 Christiansen, S. | 1984 Rattan, D.S. |
| 1972 Quon, G. 2x | 1982 Cole, G.K. | 1982 Partridge, J.E. | 1984 Pollard, P.R. | 1983 Orr, A.C. | 1988 Tom, J.C.K. | 1983 Orr, A.C. | 1988 Tom, J.C.K. | 1983 Orr, A.C. | 1988 Tom, J.C.K. | 1983 Orr, A.C. | 1988 Tom, J.C.K. |
| 1974 Cheng, K.M. | | | | | | | | | | | |
| z) W.G. (B.I.) Howard Memorial Foundation Bursary | | | | | | (α) Pacific Petroleum Ltd. Scholarship | | | | | |
| 1978 MacLauchlan, A.B. | 1990 Stevenson, A.J. | 1976 Schlichter, H.G. | 1978 Kornfeld, G.L. | 1976 Tam, S.L. | 1988 Milner, B.A. | 1976 Schlichter, H.G. | 1978 Kornfeld, G.L. | 1976 Schlichter, H.G. | 1978 Kornfeld, G.L. | 1976 Schlichter, H.G. | 1978 Kornfeld, G.L. |
| 1980 Schmalz, R.A. | 1991 Ivers, P.A. | 1977 Nardai, R.E. 2x | 1979 Jeong, K.F. | 1980 Zahary, J.E. | 1991 Koren, T. | 1977 Nardai, R.E. 2x | 1979 Jeong, K.F. | 1977 Nardai, R.E. 2x | 1979 Jeong, K.F. | 1977 Nardai, R.E. 2x | 1979 Jeong, K.F. |
| 1986 Torva, D.A. | | | | | | | | | | | |
| (γ) Tony Neidermayer Memorial Bursary | | | | | | (θ) Schlumberger Collegiate Award | | | | | |
| 1983 Rattan, D.S. 2x | 1988 Thong, C.Y. | 1979 Inruh, E.H. | 1982 Merratt, A.P. | 1989 Peterson, B.D. | 1992 Szuch, G.C. | 1983 Rattan, D.S. 2x | 1988 Thong, C.Y. | 1979 Inruh, E.H. | 1982 Merratt, A.P. | 1989 Peterson, B.D. | 1992 Szuch, G.C. |
| 1986 Hugo, R. | 1993 Chan, R.W.S. | 1984 Swystun, R.L. | 1985 Klemmner, M.S. | 1990 Yuan, G.G. | 1993 Doering, B.J. | 1986 Hugo, R. | 1993 Chan, R.W.S. | 1984 Swystun, R.L. | 1985 Klemmner, M.S. | 1990 Yuan, G.G. | 1993 Doering, B.J. |
| 1986 Kim, C.Y. | | | | 1991 Wilks, D.S. | | 1986 Kim, C.Y. | | | | 1991 Wilks, D.S. | |
| (ω) Others | | | | | | | | | | | |
| 1965 Sabourin, P.W. | Assoc. of Prof. Eng. of Alberta, APEA, Sch. Eng. Inst. of Canada, EIC, Calg. Branch Sch. Eng. Inst. of Canada, EIC, Calg. Branch Sch. | | | | | 1984 Bial, K.A. | Canadian Bechtel Ltd. Bursary | | | | |
| 1967 Mathiesen, B.J. | West Canadian Graphic Scholarship | | | | | Goodchild, J.R. | Jnderwood McLellan Ltd. Scholarship | | | | |
| 1968 Dumka, D.N.H. | Beppo Paint Ltd. Bursary in Eng. | | | | | Weiss, M.H. | Husky Oil Operations Ltd. Scholarship | | | | |
| 1969 Cheng, T. | B.M. Thomas J. Watson Memorial Bursary | | | | | Curnie, R. | ASHRAE Scholarship in Mechanical Eng. - 2x | | | | |
| Doig, L.G. | R. J. Broderick Memorial Scholarship | | | | | Powell, K.C. | W.H.B. Sharp Memorial Scholarship in Eng. | | | | |
| 1971 Patterson, M.G. | Bapco Pain Ltd. Bursary in Engineering | | | | | Smith, C.M. | Dome Petroleum Ltd. Bursary | | | | |
| Quon, G. | Standard Oil (Indiana) Foundation Scholarship | | | | | Weiss, M.H. | EIC Student of the Year Medal | | | | |
| Quon, G. | Can. Soc. of Exploration Geophysicists Sch. | | | | | Dick, K.E. | W.H.B. Sharp Memorial Scholarship in Eng. | | | | |
| 1972 Hult, V.A. | Commonwealth Construction Co. Ltd. Bursary | | | | | Flanagan, C.D. | Gerald Roberts & Victor Emmanuel Mortimer Sch. | | | | |
| Kohut, D.R. | Canadian Bechtel Ltd. Bursary | | | | | Price, G.R. | Suncor Inc. Scholarship in Engineering | | | | |
| 1976 Laustsen, D.B. | Trotter & Morton Ltd. W. Watson Bursary | | | | | Kasper, S.B. | Wilma Elizabeth Mitchell Memorial Bursary | | | | |
| Lung, T.Y. | Cominco Scholarship | | | | | Kowch, R.P. | McMahon Stadium Society/City of Calgary Award | | | | |
| 1977 Lung, T.Y. | Hudson's Bay Oil & Gas Co. Ltd. Scholarship | | | | | Schober, C.E. | William Keyte Memorial Bursary 2x | | | | |
| Tam, S.L. | W.H.B. Sharp Memorial Scholarship in Eng. | | | | | Born, M.W. | Petroleum Joint Venture Assoc. Bursary | | | | |
| 1979 Kornfeld, G.L. | EIC Calgary Branch Scholarship | | | | | Eckstein, M.W. | Digital Equipment of Canada Ltd. Award of Merit | | | | |
| Kornfeld, G.L. | Kaiser Oil Ltd. Bursary | | | | | Engler, K.S. | EIC Calgary Branch Scholarship | | | | |
| Schmalz, R.A. | Commonwealth Construction Co. Ltd. Bursary | | | | | Kasper, S.B. | John & Anthony Pearson Memorial Bursary | | | | |
| Trick, M.D. | Suncor Inc. Scholarship in Eng. | | | | | Milner, B.A. | Gerald Roberts & Victor Emmanuel Mortimer Sch. | | | | |
| 1980 Brown, A.P. | Troiter & Morton Ltd. W. Watson Bursary | | | | | Springer, M.J.M. | R.W. Zwicky Memorial Scholarship | | | | |
| Sikretka, R.P. | BP Canada Scholarship | | | | | van der Vliet, A.D.E. | Encor Energy Corp. Inc. Scholarship | | | | |
| Vermeulen, S.O. | The U. of C. Support Staff Undergraduate Bursary | | | | | Clavette, E.J. | Union Pacific Resources Inc. Scholarship | | | | |
| 1981 Brennan, R.W. | Faculty Women's Club of Calgary Prize | | | | | Hoven, P.D. | Enron Oil Canada Ltd. Bursary | | | | |
| Evans, T.E. | Jnderwood McLellan Ltd. Scholarship | | | | | Machacek, T.J. | BP Canada Scholarship | | | | |
| Wmacker, D.J. | Dolphin Drilling Ltd. Scholarship | | | | | Milner, B.A. | Lou Goodwin Univ. Athletic Board Bursary | | | | |
| 1982 Daniel, S.D. | Canadian Bechtel Ltd. Bursary | | | | | Scholarius, S.T. | Digital Equipment of Canada Ltd. Award of Merit | | | | |
| Geppert, E.C.J. | Canyon Engineering & Construction Scholarship | | | | | Wilson, T.E. | Gerald R. & Victor Emmanuel Mortimer Sch. | | | | |
| Harrison, M.K. | Home Oil Co. Ltd. Centennial Scholarship, 3x* | | | | | Wilton, Clark, H. | CSME Medal | | | | |
| Leblanc, A.J. | Dr. Cal Waddell Award | | | | | Machacek, T.A. | EIC Calgary Branch Scholarship | | | | |
| Witscher, D.J. | Dome Petroleum Ltd. Bursary | | | | | Newhouse, T.A. | Wilfred Archibald Walter Bursary | | | | |
| 1983 Forsyth, D.D. | Jnderwood McLellan Ltd. Scholarship | | | | | Sanchez, I. | CSME Medal | | | | |
| Geppert, E.C.J. | Canyon Richfield Scholarship | | | | | Stevenson, A.J. | Eng. Student Soc. Memorial Award | | | | |
| Gittins, S.D. | Dome Petroleum Ltd. Bursary | | | | | Chang, T.Y. | Suncor Inc. Scholarship in Eng. | | | | |
| Leblanc, A.J. | Petro Canada Scholarship | | | | | Gregory, C.R. | R.W. Zwicky Memorial Scholarship | | | | |
| Mark, R.A. | Dolphin Drilling Ltd. Scholarship | | | | | Gregory, C.R. | CSEM/Amoco Prize | | | | |
| Shopp, J. | EIC Student of the Year Medal (inaugural) | | | | | Klein, J.F. | John & Anthony Pearson Memorial Bursary | | | | |
| Steele, R.C. | Candel Oil Ltd. Silver Anniversary Scholarship | | | | | Lawrence, D.M. | Canadian Soc. for Mech. Eng. CSME Medal | | | | |
| 1984 Batteke, H.H. | | | | | | Newhouse, T.A. | Hans M. Nielsen Memorial Bursary | | | | |
| | | | | | | Telang, L.V. | Fluor Daniel Canada Inc. Scholarship | | | | |
| | | | | | | Yee, B.O.S. | Eng. Student Soc. Memorial Award | | | | |
| | | | | | | Telang, L.V. | CSME Medal | | | | |
| | | | | | | Tsuj, T.R.T. | Delta Catalytic Corp. Bursary | | | | |

II Graduate Scholarship, Medal and Prize Winners

| a) NRC/NSERC Postgraduate Scholarship | | | | | | | | | | | |
|---------------------------------------|------------------------|------------------------|--------------------|---------------------|-------------------|-----------------------|------------------------|------------------------|--------------------|------------------|------------------|
| 1969 D'Souza, M.V. 3x | 1971 Tsang, W.F.P. 2x | 1983 As-Himray, T.J.S. | 1984 Cheng, H.T.K. | 1987 Welch, P.A. | 1989 Rodburg, M. | 1969 D'Souza, M.V. 3x | 1971 Tsang, W.F.P. 2x | 1983 As-Himray, T.J.S. | 1984 Cheng, H.T.K. | 1987 Welch, P.A. | 1989 Rodburg, M. |
| 1971 Agbi, B.O. | 1975 Bardon, M.F.R. 2x | Kostiuk, L.W. | Poon, Y.C. 2x | 1988 Weiss, M.H. 3x | 1992 Cole, G.K. | 1971 Agbi, B.O. | 1975 Bardon, M.F.R. 2x | 1983 As-Himray, T.J.S. | 1984 Cheng, H.T.K. | 1987 Welch, P.A. | 1989 Rodburg, M. |
| Sarpar, G.S. 2x | 1979 Bayly, D.A. | Kula, L.W. | Roy, G.A. | 1989 Diakow, D. 3x | Denilkewich, H.J. | Sarpar, G.S. 2x | 1979 Bayly, D.A. | 1983 As-Himray, T.J.S. | 1984 Cheng, H.T.K. | 1987 Welch, P.A. | 1989 Rodburg, M. |
| Taylor, M.E. 2x | Pethrick, W.D. 2x | Lam, H.T. 2x | 1986 Butt, A.M. 2x | Goldsmith, P.B. | Stefanyshyn, D.J. | Taylor, M.E. 2x | Pethrick, W.D. 2x | 1983 As-Himray, T.J.S. | 1984 Cheng, H.T.K. | 1987 Welch, P.A. | 1989 Rodburg, M. |

* n x n years

II. Graduate Scholarship, Medal and Prize Winners (cont'd)

b) Zaak Walton Killam Memorial Scholarship

| | | | | | | | | | | | |
|------|-----------------|------|-------------------|------|-----------------|------|--------------------|------|---------------------|------|----------------|
| 1970 | Ah, A. 2x | 1975 | Badi, O.A. 2x | 1978 | Botros, K.K. 2x | 1980 | King, R.J. 3x | 1984 | Al-Himry, T.J.S. 3x | 1988 | Orsamolu, R. |
| 1974 | Settar, A. 2x | 1976 | Barton, M.F.R. 2x | 1979 | Segev, R. 3x | 1982 | Obrunmaje, J.A. 3x | 1987 | Bugg, J.D. 2x | 1989 | Weiss, M.H. 2x |
| | Marzouk, E.S.M. | | Metwally, M.M. | | | | | | | | |

c) Robert B. Paugh Memorial Bursary

| | | | | | | | | | | | |
|------|---------------|------|-----------------|------|-----------------|------|------------------|------|------------------|------|-----------------|
| 1971 | Howes, B.C. | 1984 | Ang, E.D. | 1989 | Laureshen, C.J. | 1983 | Kaganazawa, K. | 1986 | Molrnik, K. | 1989 | Ronsky, J.L. 2x |
| 1974 | Badi, O.A. | 1986 | Orsamolu, R. 2x | 1991 | Potter, J. | 1984 | Bahisen, A. 4x | 1986 | Molrnik, H.L. 2x | 1992 | Alinger, T.L. |
| 1981 | Soriano, B.P. | 1988 | Ronsky, J.L. | 1992 | Caswell, D.J. | | Schaeffer, F. 3x | 1989 | Cole, G. 3x | | Ronsky, J.L. |

(d) Alb Heritage Foundation for Medical Research Sch.

(e) Province of Alberta Graduate Scholarship/Fellowship

| | | | | | | | | | | | |
|------|------------|------|---------------|------|----------------|------|------------------|------|----------|------|--------------|
| 1968 | Mika, K. | 1972 | Settari, A. | 1983 | Jones, W.G. 2x | 1988 | Ronsky, J.L. | 1991 | Cole, G. | 1991 | Ronsky, J.L. |
| 1972 | Khosla, A. | 1982 | Soriano, B.P. | 1984 | Ang, E.D. | 1991 | Caswell, D.J. 2x | | Kwok, A. | 1992 | Pan, J. |

(f) Others

| | | | | | |
|------|-------------------|--|------|---------------------|---|
| 1978 | Hanafi, A.S.A. | Alberta Oil Sands Technology & Research Authority AOSTRA Scholarship/Fellowship 2x | 1986 | Mehta, S.A. | AOSTRA Scholarship. 4x |
| 1979 | King, R.J. | Francis F. Reeve Foundation Bursary | 1989 | Bugg, J.D. | John S. Poyen Scholarship |
| 1981 | Jones, W.G. | Dalco Petroleum Ltd. Graduate Scholarship | | Laureshen, C.J. | Home Oil Co. Ltd. R.A. Brown Jr. Mem. Fellowship |
| 1981 | Soriano, B.P. | Archibald Wayne Dingman Mem. Grad. Sch. | | Ronsky, J.L. | Sceptre Resources Ltd. Graduate Scholarship |
| 1981 | Jones, W.G. | Dynex Petroleum Ltd. Grad. Scholarship | | | Can. Federation of University Women Alice E. Wilson Scholarship |
| 1983 | Ogundele, G. | Archibald Wayne Dingman Mem. Grad. Sch. | | Ronsky, J.L. | Wilfrid R. May Scholarship for Career Dev. 2x |
| 1983 | Soriano, B.P. | Archibald Wayne Dingman Mem. Grad. Sch. | | Ronsky, J.L. | 1989 North American LiverCCPE Scholarship. 2x |
| 1983 | Vermeulen, S.O. | Alberta Heritage Ralph Steinhauer Award of Distinction. 2x | | Weiss, M.H. | Canada Medical Research Council Studentship |
| 1984 | Jones, W.G. | Harry & Laura Jacques Bursary | 1990 | Wierzb, P. | John Davies Memorial Scholarship |
| 1985 | Laureshen, C.J. | AOSTRA Scholarship | | Bade Shrestha, S.O. | Can. Int. Dev. Agency, CIDA, NEPAL Eng. Education Project Scholarship |
| 1985 | Vermeulen, S.O. | Archibald Wayne Dingman Mem. Grad. Sch. | | Guo, D. | Alberta Research Council Scholarship |
| 1986 | Bakalchuk, V. | Canada Medical Research Council Studentship, 2x | | Huang, H. | AOSTRA Scholarship. 2x |
| 1986 | Fernandes, L.C.V. | Manitoba Architectural Society's John Davies Mem. Sch. | | Weiss, M.H. | Alberta Heritage Ralph Steinhauer Award of Distinction |
| | | Conselho Nacional de Desenvolvimento Científico e Tecnológico/Brazilian Government Sch. 4x | 1991 | Jameel, M.I. | Ian N. McKinnon Mem. Fellowship |
| | | | 1992 | Pan, J. | A.S.M. Int. Calgary Chapter Scholarship |
| | Kyejo, D.T. | Canadian Commonwealth Scholarship. 4x | | | |

III Staff Awards and Achievements

| | | | | | |
|------|------------------------------|--|------|----------------------------------|---|
| 1962 | Doige, A.G. | R.W. Herrick Foundation Fellowship, Purdue Univ. | 1980 | Vermeulen, P.J. | Awarded Killam Resident Fellowship, Fall '79 |
| 1967 | Norrie, D.H. | Elected Fellow, Royal Inst. Naval Architects | | Glockner, P.G. | Elected Fellow, Eng. Institute of Canada, EIC |
| 1968 | Groves, T.K. | Established Oil Explosives and High Pressure Research Laboratory, Ogden, Calgary S.E. | | Kentfield, J.A.C. | Awarded Killam Resident Fellowship, Winter '80 |
| 1969 | Walker, G. | Completed oil painting portraits of Dean A.M. Neville and Chancellor C.C. McLaughlin | | Vinogradov, O.G. | Best paper award, Int. Metallographic Society 'Stirling Engines' Oxford University Press, 532 pp. Chinese ed., 1982. Russian ed., 1985 |
| 1969 | Norrie, D.H. | Elected President TUCFA | 1982 | Walker, G. | 'Industrial Heat Exchangers: The User Guide Hemisphere Publ. 408 pp. |
| 1970 | Kentfield, J.A.C. | Patents: 'Improvements to fluid rectifiers - U.K. #1,202,895 and U.S. #3,543,781 | 1983 | Epstein, M. & Segev, R. | An Invariant Theory of Stress and Equilibrium in 'Mathematical Foundations of Elasticity Prentice-Hall |
| 1971 | Kentfield, J.A.C. | British patent on 'Improvements in or Relating to Desalination' #1,233,005 | | Glockner, P.G. | ASCE's Morrisell Medal and Award for 1983 |
| | Torvi, A.A. | Recipient of Outstanding Young Faculty Award, ASCE-PNWS, Banff, May 15, 1981 | | Walker, G. | 'Cryocoolers: vol. Fundamentals 363 pp. vol. II Applications 423 pp. Plenum Press |
| 1972 | Karim, G.A. | Awarded DSc. Imperial College The University of London | 1984 | Walker, G. & Senft, J. | 'Free Piston Stirling Engines' Springer 283 pp. |
| 1972 | Norrie, D.H. & deVries, G. | 'The Finite Element Method: Fundamentals & Applications' Academic Press, 316 pp. | 1985 | Epstein, M. | 'Introduction to the Finite Element Method in Elasticity' The J of C |
| | Walker, G. | 'Stirling Cycle Machines' Oxford University Press, 156 pp. Russian edition, 1979 | | Glockner, P.G. | Awarded CSME Service Certificate |
| 1975 | Norrie, D.H. & deVries, G. | Application of the Pseudo-Functional Finite Element Method to Nonlinear Problems | 1985 | Glockner, P.G. | Elected Fellow of CSME |
| | | 'Finite Element Methods in Flow Problems' John Wiley & Sons, pp. 55-65 | | Glockner, P.G. | Elected Fellow of ASCE |
| 1976 | Glockner, P.G. | Awarded ASME Distinguished Service Certificate | | Shaw, W.J.D. | 1st Prize, Int. Metallographic Society's Scanning Electron Microscopy Contest and Exhibit, Boston |
| | Karim, G.A. & Hamilton, B.A. | 'Metrication and SI Units for the Oil & Gas Industry' 3 volumes, The U. of C. | | Walker, G. | Patents: 'Improvements in Stirling Engines' U.K. #8,621,258, Joule Thomson Apparatus for Temperature Sensitive Annular Extension Passageway U.S. #4,631,928 |
| | Norrie, D.H. & deVries, G. | 'Finite Element Bibliography' Plenum Press, 686 pp. | 1987 | Glockner, P.G. | Elected Fellow, American Academy of Mechanics |
| | Walker, G. | Completed large, 12' 0" x 6' 0" painting of the crucifixion, presented to Brentview Baptist Church | | Glockner, P.G. & Szyszkowski, W. | 'On the Stability of Columns Made of Time-Dependent Materials' Chapter 23, vol. 1 Structures, Civil Engineering Practice Technomic Publ. Co., pp. 577-626 |
| 1978 | Norrie, D.H. & deVries, G. | 'Finite Element Analysis' Academic Press, 701 pp. Russian edition, 1981 | | Norrie, D.H. (ed.) | 'Finite Element Handbook' McGraw-Hill 1,424 pp. |
| | Norrie, D.H. & deVries, G. | A Survey of Finite Element Applications in Fluid Mechanics' in 'Finite Elements in Fluids' vol. 3, John Wiley & Sons | 1988 | Norrie, D.H. | Appointed Adjunct Prof. of Computer Science Faculty of Science, The U. of C. |
| 1979 | Walker, G. | Awarded Killam Resident Fellowship, Winter '78 | | Walker, G. | 'Heat Exchanger Technology' in 'Handbook of Thermal Design' McGraw-Hill |
| | Epstein, M. | video film, 'Women in Engineering' | | | |
| | Norrie, D.H. | Awarded Killam Resident Fellowship, Winter '79 | | | |

* n x n years

III. Staff Awards and Achievements (cont'd)

| | | | | | |
|------|---------------------|---|------|--|---|
| 1989 | Lukasiewicz, S.A. | "Thermal Stresses in Shells" In: Thermal Stress III North Holland, pp. 355-353 | 1992 | Epstein, M. | Appointed Adjunct Prof., Physical Education |
| | Norme, D.H. | President, Alberta Science Centre Society, Calgary | | Epstein, M. | Recipient of The U of C Engineering Students Society's Teaching Excellence Award |
| | Walker, G. | "Miniature Refrigerators for Cryogenic Sensors and Cold Electronics" Oxford, 208 pp. | | Lukasiewicz, S.A. | Patents on "Universal Expansion Joint" Cdn #1,294,996, and Polish #1,221,27 |
| 1990 | deKrasinsky, J.S.A. | Polish Patent on radial diffuser #141,552 | | Karim, G.A. | Recipient of Society of Automotive Engineers International Outstanding Faculty Award |
| 1991 | Glockner, P.G. | Honorary President CANCAM '91, Winnipeg, | | Kentfield, J.A.C. | Recipient of the Canadian Wind Energy Association's R.J. Templin Award |
| | Karim, G.A. | Imperial Oil Ltd's Certificate of Research Excellence | | Kentfield, J.A.C. | "Nonsteady One Dimensional Internal Compressible Flows: Theory and Applications" Oxford University Press, 284 pp. |
| | Lukasiewicz, S.A. | Patents on An Automatic Photoelastic Stress Analyser U.S. #5,042,944, August 27, 1991, and Cdn. #1,322,864, Oct. 12, 1993 | | Torvi, A.A. | CSME Certificate of Service |
| | Mao, X. | Imperial Oil Ltd's Certificate of Research Excellence | 1993 | Glockner, P.G. | Recipient 1993 CANCAM Medal & Award |
| | Reader, G.T. | Japan Society of Mechanical Engineering Medal | | Reader, G.T. | 13th International Boulmer-Lytton Literary Prize |
| | Vinogradov, O.G. | "Introduction to Mechanical Reliability: A Designer's Approach" Hemisphere Publ., 140 pp. | | Walker, G. & Reader, G.T. & Fauvel, O.R. | "The Stirling Alternative" Gordon & Breach Ltd 220 pp |

**Table 6.4 LIST OF ACADEMIC AND SUPPORT STAFF 1966-91
DEPARTMENT OF MECHANICAL ENGINEERING**

ACADEMIC STAFF

| | | | | | |
|-------------------|---------------------|-------------------|--------------------|---------------------|--------------------|
| Betts, P. | 1976-1976 | Gu, P. | 1990-present | Reddy, D.V. | 1968-1969 |
| Botros, K.K. | 1979-1981 | Hajdo, J.E. | 1977-1990 | Rogers, P. | 1991-present |
| Brar, G. | 1976-1981 | Hebbert, R.H.B. | 1959-1963 | Rowe, R.D. | 1981-present |
| Bush, M.J. | 1977-1981 | Huber, G.D. | 1968-1974 | Ruth, D.W. | 1977-1980 |
| Culver, R. | 1970-1972 | Huttenmaier, H.P. | 1979-1986 | Shaw, W.J.D. | 1981-present |
| Dagnino, A. | 1990-present | Johnson, E.W. | 1970-1989 | Silovsky, K. | 1989-1990 |
| Dang, D.Q. | 1977-1979 | Karim, G.A. | 1968-present | Singh, M.C. | 1968-present |
| DeKrasinsky, J.S. | 1968-1979 (Emerit), | Kentfield, J.A.C. | 1970-present | Smith, G.F. | 1975-1978 |
| Devries, G. | 1968-1980 | Kessey, K.O. | 1980-1982 | Swisterski, W. | 1987-1988 |
| Doige, A.G. | 1959-1989 (Emerit), | Lukasiewicz, S.A. | 1981-present | Szyszkowski, W. | 1982-1986 |
| Dost, S. | 1980-1989 | Malcolm, D.J. | 1976-1980 | Torvi, A.A. | 1969-present |
| Duplessis, M. | 1977-1980 | Mao, X. | 1989-present | Tsai, C.W.S. | 1981-1986 |
| Eder, W.E. | 1968-1977 | Mikulic, E.C. | 1968-1992 (Emerit) | van der Ven, J.E.S. | 1964-1973 |
| Eikrem, A.K. | 1973-1976 | Mishra, A.K. | 1974-1976 | Vermeulen, P.J. | 1970-1993 (Emerit) |
| Elzanowski, M. | 1981-1988 | Nigg, B. | 1981-present | Vinogradov, A.M. | 1978-1980 |
| Engsberg, J. | 1991-present | Norrie, D.H. | 1966-present | Vinogradov, O.G. | 1978-present |
| Epstein, M. | 1976-present | Page, R. | 1968-1970 | Walker, G. | 1967-present |
| Fauvel, O.R. | 1982-present | Petela, R. | 1985-1989 | White, W.F. | 1977-1987 |
| Frydrychowicz, W. | 1984-1985 | Pivovarov, I. | 1984-present | Wierzbna | 1980-present |
| Glockner, P.G. | 1976-1994 (Emerit), | Pollard, A. | 1978-1981 | Winnikow, S. | 1965-1967 |
| Groves, T.K. | 1966-1986 | Reader, G.T. | 1988-present | Yallin, M. | 1967-1969 |

SUPPORT STAFF

Secretarial

| | |
|--------------|--------------|
| Bauder, M. | 1982-1983 |
| Berry, M. | 1985-present |
| Buckton, J. | 1976-1978 |
| Burke, S. | 1979-1981 |
| Carter, E. | 1967-1968 |
| Clarke, M. | 1987-1990 |
| Daley, B.S. | 1989-present |
| Dolan, S. | 1974-1976 |
| Evans, P. | 1988-1994 |
| Germaine, B. | 1967-1968 |
| Good, S. | 1978-1980 |
| Goss, K. | 1986-1992 |
| Hedstrom, J. | 1978-1980 |
| High, A. | 1970-1976 |
| Hittie, R. | 1969-1977 |
| Klarholm, K. | 1983-1985 |
| Kuervers, L. | 1990-present |

| | |
|-----------------|--------------|
| Lacombe, A. | 1986-1990 |
| Mackenzie, L. | 1985-1987 |
| Maylor, B.A. | 1969-1978 |
| McLellan, S. | 1968-1969 |
| Murdock, S. | 1969-1971 |
| Nicholson, F. | 1985-1987 |
| Pawlowich, J. | 1990-1991 |
| Pfisterer, J. | 1976-1978 |
| Richards, N. | 1985-1986 |
| Ringer, M. | 1981-1985 |
| Roe, K. | 1969-1970 |
| Swenson, M. | 1967-1969 |
| Timmermanns, J. | 1985-1988 |
| Undseth, K. | 1977-present |
| Watson, S. | 1968-1972 |
| Work, K. | 1982-1983 |
| Zibin, K. | 1980-1984 |

Technical

| | |
|-----------------|--------------|
| Anson, W. | 1968-1987 |
| Bechtold, R. | 1968-1994 |
| Boiton, G. | 1981-1985 |
| Channah, S. | 1967-1969 |
| Crews, B. | 1970-1988 |
| Daley, B.S. | 1989-present |
| East, G. | 1980-present |
| Ferguson, B. | 1990-present |
| Gustafson, R. | 1968-present |
| Halkett, P. | 1969-1986 |
| Hefley, C. | 1968-1980 |
| Holdsworth, J. | 1967-1980 |
| Johnson, M. | 1986-present |
| Kok, J. | 1967-1969 |
| Moerhie, A. | 1967-present |
| Platt, A. | 1967-1970 |
| Rowell, R. | 1988-1990 |
| Sanders, B. | 1967-present |
| Scorey, R. | 1988-1989 |
| Sharpe, L. | 1986-1988 |
| Stephens, B. | 1986-present |
| Thomas, R. | 1967-1972 |
| Tyler, D. | 1971-1973 |
| Vogt, N. | 1968-present |
| Waterhouse, G. | 1969-1972 |
| Wilkinson, J.B. | 1989-1994 |



9. Calisthenics and fresh air, excellent place for Alfred K. and David Norris. 10. Just simply enjoying the September sunshine between classes. 11. A group of students sitting on a lawn, view from left to right: Warren Gieck, Steve Bickman, Bruce Fenn and Ray Olszewski. — Sept. 4, 1961.



12. One of the Frosh Week activities sponsored by the Engineering Students Society. The traditional flag football game is shown here. One of the team, among players, is a student who is a member of the Engineering Society. The student in the foreground is a member of the Engineering Society. — Sept. 8, 1961.

Plate P — Some student fun activities.

A Place of
Ingenuity

VII.

Department of
SURVEYING
ENGINEERING

THE SILVER ANNIVERSARY

The Department of Surveying Engineering is the only offspring in the Faculty up till 1993. It was born as a Division within Civil Engineering and developed quickly into a thriving organization, full of vitality and dynamism. It is unique in a number of other ways as well, including the fact that it is the only such department in Western Canada. It was specifically established for and is strategically located to serve the needs of Western Canada and the developing north both in educating the surveying professionals required for this part of the country as well as in carrying out research and development work in modern Surveying Engineering which is relevant to the regions. Even though the Surveying Engineering programme is only a dozen years old in 1991 the Department has established itself, nationally and internationally, as a recognized school and center of research in surveying and has taken a leading role in a number of research specializations. Also, it has achieved a number of *firsts* in educating Surveying Engineering professionals.

Since its initiation, Surveying Engineering has been located in the E Block which it shared with Civil

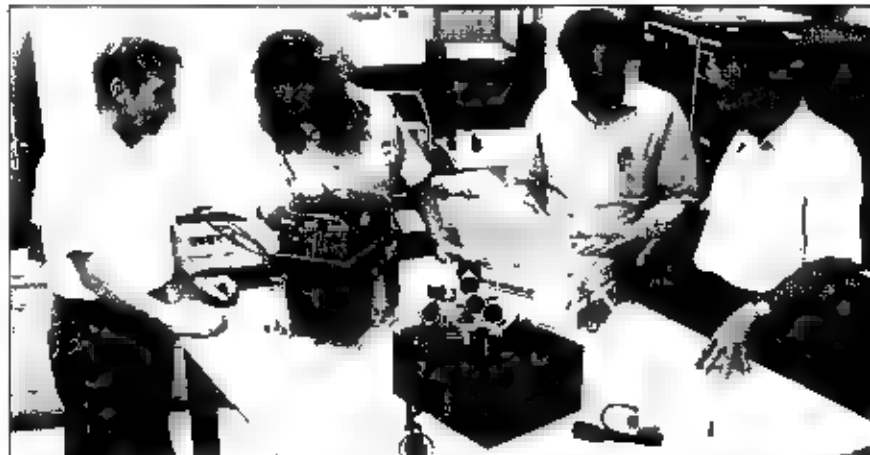


Plate 7.1 The Geodesy and Navigation Group with some of their equipment, obtained through major equipment grants or donations from industry. L to R: Drs. K.P. Schwarz, M.E. Cannon, G. Lachapelle, P.J. Krakowsky, 1991

Engineering during the first 2½ years of its existence as a Division. In 1982, after Civil Engineering moved into its new home (F-Block), renovations were carried out to modify E-Block to conform to the needs of Surveying Engineering.

The 1990-91 official university enrolment statistics show 76 Surveying Engineering students, including 45 undergraduates, 20 full-time and 11 part-time graduate students (see Fig. 7.1). Some 11% and 20% of the un-

dergraduate and graduate students respectively, are females. Departmental statistics indicate 4 more graduate students, enrolled after January 1, 1991, and 15 undergraduate students taking mixed programmes, including third year Surveying Engineering courses. The 1990 Spring and Summer session registrants in Surveying Engineering courses are not included in these figures. The majority of undergraduate students are from Alberta. There are



Plate 7.2 — Ground and satellite-based radionavigation is an intense area of research for members of the geodesy group. The picture shows the test vehicle with navigation and positioning equipment installed, forming a system referred to as "VIRTUAL" and developed by Prof. Lachapelle and his team of graduate students. Some of the Department's GPS navigation/positioning equipment was obtained through two major NSERC equipment grants to Drs. Lachapelle and Schwarz during the period 1988-91, totalling \$144,000. This research is supported also using grant and contract funding from Communications Canada and Fisheries and Oceans Canada.

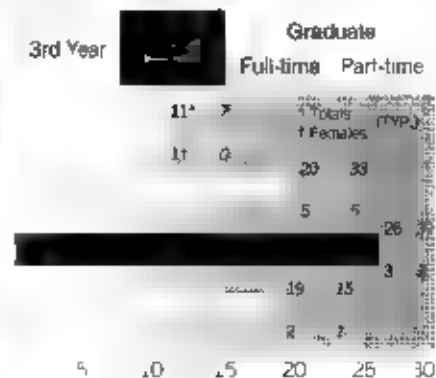


Fig. 7.1 Registration Statistics For Surveying Engineering - Fall 1990 (with 1991 figures in *italics*)

however, registrants who hail from British Columbia, Saskatchewan, Manitoba, Ontario and the United States. The graduate student population is quite cosmopolitan, underlining the Department's recognition as a Surveying Engineering research centre around the globe. Graduate stu-

students in programme during 1990-91 are from 12 different countries including China, Egypt, England, Germany, Hong Kong, Hungary, Indonesia, Iran, Kenya, Poland and Saudi Arabia and the USA. During 1990 there were 19 BSc, 1 PhD, 2 MSc and 3 MEng degrees awarded in Surveying Engineering with an additional 17 BSc, 2 PhD, 5 MSc and 4 MEng students graduating in 1991 (see Fig 7.2). There were 15.6% women amongst the 1990 BSc graduates while exactly half the graduate students were females including the first woman to be awarded a PhD degree in Surveying Engineering in Canada, E Friede Thekla Knickmeyer. Three of the 7 graduate student degree recipients in June 1991 were females.

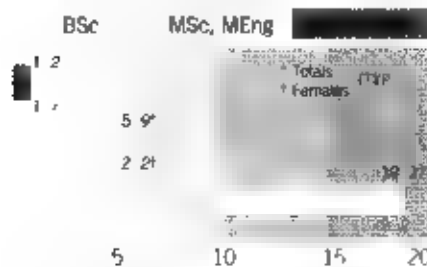


Fig 7.2
Convocation Statistics for Surveying Engineering 1990
with 1991 figures in italics

Many of the students, both undergraduate and graduate, excelled in their studies. Two of the outstanding Surveying Engineering students, Elizabeth Cannon and Rob Hare, have already been highlighted in the Faculty Chapter. Other winners of national and international prizes and awards include the following: Yang Gao, the recipient of the Institute of Navigation (ION), Best Student Paper Award at the 1990 meeting in Colorado Springs, USA who also won a major provincial scholarship; Joseph Czompa, Yang Gao and Gang Lu, winners of 1991 ION Awards in Albuquerque, New Mexico; Henry L., the winner of an NSERC Scholarship. On Students' Awards Night, October 10, 1990, the eve of the meeting of the Surveying Engineering Advisory Committee, 18 awards were presented to

undergraduate and graduate students including the following:

- the J. H. Holloway Scholarship for U of C undergraduates (\$1,500) to Rob Hare
- the McElhanney Scholarship (\$1,000), the LEICA Canada Ltd Scholarship (\$500) and the Walker, Newby and Associates Ltd Award (\$1,000) won by Rudy Digiovanni
- the Corporation of Land Surveyors of the Province of B.C. Award (\$1,000), the Stephen P. Williams Memorial Award (\$400) and the C.M. Calgary Branch Scholarship (\$1,750) awarded to Ian Lloyd
- the Walker, Newby and Associates Ltd Award for Graduate Studies in Surveying Engineering (\$1,000), won by Brian Townsend,
- the H. Moritz Graduate Award in Surveying Engineering (\$2,000) presented to Dariusz Lapucha

A highlight of the year for Surveying Engineering was the appointment of two new staff members. On Jan. 1, 1991, Dr. Alec C. McEwen joined the Department as the inaugural appointee to the newly established Professorship in Cadastral Studies, made possible by the financial support from the four western Canadian Land Surveying Associations, a further indicator of the continuing strong support provided by the pro-



Plate 7.3 Dr. E.J. Krakowsky with a model of the Chinese South-Pointing Chariot, one of the earliest automatic vehicle location and navigation (AVLN) systems which used the principle of differential odometry still used in today's AVLN systems. (Model created by Sumitomo Electric Industries Ltd. 1 - 1991)

fession to this programme and department. Dr. M. Elizabeth Cannon, a PhD graduate from Surveying Engineering in Calgary in the Spring of 1991, was selected as one of only four recipients of the new NSERC Women's Faculty Awards which made possible her appointment as Assistant Professor in the Department effective May 1, 1991. The position vacated by Dr. Graham D. Lodwick's resignation effective Jan. 1991, was returned to the Department and was filled by hiring Dr.

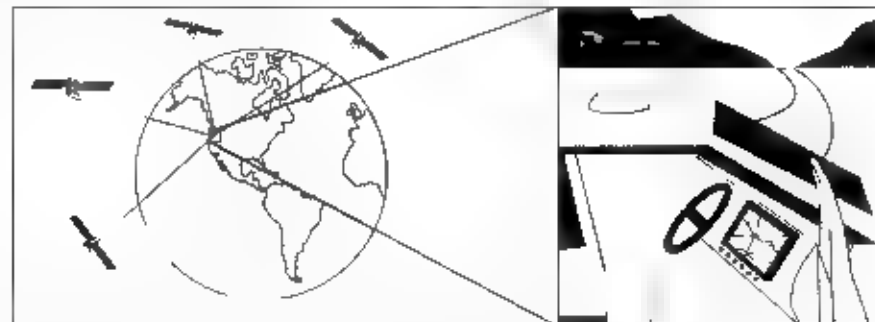


Plate 7.4 Automatic Vehicle Location and Navigation. AVLN is a specialty within the broader area of ground and satellite-based radionavigation. The concept of a modern AVLN system is shown here schematically. With a team of coworkers and two successive NSERC equipment grants, Dr. Ed Krakowsky developed and built a prototype system called AVL 2000. A Calgary firm licensed this technology, built its own system, called NAVTRAX 2000 which was installed in the City of Calgary Police Department to facilitate the dispatching of the closest vehicle to a 911 call and to assist officers in trouble.

Peng Gong in August 1991 thereby bringing the total number of full-time academic staff in Surveying Engineering to 11 very near to the planned staff complement of 12.

In carrying out their teaching and research related tasks, the academic staff was supported by 5 research associates and post doctoral fellows, 2 visiting scholars, 2 distinguished lecturers and 8 support staff (see Plate 7.7 and Table 7.1). Most of the full-time graduate students were involved in undergraduate teaching as Graduate Teaching Assistants (GTAs). The operation of the Department was funded through a \$1.01 million and \$0.3 million operating and capital budget respectively, as well as external research funding of \$1.03 million, including \$0.25 million in equipment donations.

The Department of Surveying Engineering and the programme was a long-standing dream of the surveying profession in Western Canada and was created through the initiative of that profession. The bond created by that successful initiative has resulted in cooperation which continues. One manifestation of this bond is the Advisory Committee which continued to serve as a pipeline between industry and the Department during 1990-91. Under the chairmanship of Alex Hitter, the Department's staunch supporter and



Plate 7.5 - Four members of the Geomatics Group in Surveying Engineering are analyzing and discussing data use patterns near an expanding urban centre. L to R: Drs. Rod Blais, Peng Gong, Mike Chapman and Ian Crain. (1991)

one of the major driving forces behind the original industry initiative, the Committee provided input and guidance to the Department in accordance with its terms of reference. At its 13th annual meeting held on Oct. 26, 1990, the Committee dealt with a number of items including the newly established professorship in Cadastral Studies and its impact on CCUS accreditation, the long range plans of the Department, and changes in Committee structure and membership.

The Department has recently decided to concentrate its efforts in achieving prominence in graduate work and research in three major Surveying Engineering specializations:

- geodesy and navigation
- spatial information systems and cadastral studies
- precise engineering surveys

Thus there are three main groups of researchers in the Department. The first group includes Drs. M.E. Cannon, E.J. Krakowsky, G. Lachapelle, K.P. Schwarz and M.G. Sideris (see Plate 7.1). The expertise and research interests of this group include the theo-

retical foundations of geodesy, global positioning systems, GPS, inertial navigation systems, INS, gravity field approximation, land and satellite-based radio navigation systems for marine, airborne and land applications, integrated navigation systems, automatic vehicle location and navigation systems, AVLN, precise static and kinematic positioning, GPS/INS integration and real time positioning (see Plates 7.2 and 7.3).

The second so-called *geomatics group*, includes Drs. J.A.R. Blais, M.A. Chapman, I.K. Crain, A.C. McEwen and the newly appointed Peng Gong (see Plate 7.5). The research focus of this group is directed towards studies on information theory and systems, reference systems and gravitation, estimation and spectral analysis, numerical methods, digital terrain modelling, photogrammetric control densification, digital image processing and medical image processing, land information and registration systems, urban environmental and global geographic information systems, cadastral studies, survey law, international land and maritime boundaries surveys for aboriginal land claims, and satellite remote sensing.

The third group includes Drs. M.A. Chapman, K.P. Schwarz, M.G. Sideris and W.F. Teskey who are conducting research on photogrammetric techniques in deformation monitoring, optimization in surveying, statistical and spectral analysis.



Plate 7.6 - The Precise Engineering Surveys Group discussing the use of a high precision coordinate and CCD camera in monitoring the structural performance of the \$38.4 million Olympic Speed Skating Oval at The University of Calgary. L to R: Drs. M.A. Chapman, M.G. Sideris and W.F. Teskey. (1991)

Appointed Assistant Prof.

precise engineering and deformation surveys and integrated analysis of deformations.

Excellent research facilities are available for studies in all areas. The equipment used was obtained primarily through major equipment grants and equipment donations from industry.

Results of the research work of the Surveying Engineering staff during 1990 was made available to the engineering and scientific community and industry through 40 publications. The staff also presented papers at national and international conferences and gave invited lectures and short courses around the globe. For example, Dr. I.K. Crain was guest lecturer at the National Resource Information Center in Canberra, Australia at the Geography Department in Birkbeck College, London, U.K. and at a meeting of the Gesellschaft für Strahlen und Umweltforschung in Munich, West Germany. Dr. Gerard Lachapelle gave invited lectures and courses to the personnel of Communications Canada in Ottawa. He also gave courses in New Orleans and in Leverkusen, Germany. He was invited to offer a graduate course at the Chung Cheng Institute of Technology in Taiwan in March 1991. Drs. Schwarz and Lachapelle gave lectures at a GPS seminar series in Colorado Springs as well as lectures on GPS at a meeting in Edmonton organized by the Canadian GPS Associates for the Canada Land Surveyor Profession.



Plate 7.8 The Surveying Engineering technical staff in the Photogrammetric laboratory examining the Wild T2000/2100 vGRE3 electronic theodolite and EDM data collector. (L to R) Messrs. Keith Robinson, Garth Wanamaker and Michael C. Szarmes, 1991.



Plate 7.7 The Surveying Engineering secretarial staff with their Department Head discussing some problem and problem in the working process. (L to R) Dr. K.P. Schwarz, Mrs. Sandra Kelly, Mrs. Anne Gehring, Mrs. Marguerite Anderson, Mrs. Julia Lai, seated. 1991.

The Department's stature is underlined by the involvement of its members in the organization of national and international conferences. For example, Dr. G. Lachapelle was Chairman of the 8th Canadian Navigation Symposium held in Toronto May 14-15, 1990. Dr. E.J. Krakiwsky with the help of Drs. Blais, Chapman and Sideris organized the XII North American Surveying and Mapping Conference held in Banff June 22-25, 1990. Drs. K.P. Schwarz and G. Lachapelle were responsible for the International Symposium on Kinematic Systems in Geodesy, Surveying and Remote Sensing, K.S.'90, in Banff September 10-13, 1990.

In addition to the highlights and achievements of students and staff indicated above and in the SURVER

ANNIVERSARY Section of Chapter 1, significant events in Surveying Engineering during the 1990-91 academic year include the following:

- Establishment of an up-to-date Micro Computer Laboratory including over a dozen A.R. 386-33 MHz Business V.E. SA computers with VGA graphics cards and 13 inch color monitors which was made possible through a major capital budget allocation by the University Budget Committee. Its effectiveness was increased through software donations valued at over \$250,000, including special software for digital imaging.
- The Distinguished Lecturer Series continues to provide a special flavour to the graduate programme in Surveying Engineering. During the past year two short courses were given: one by Professor Dr. H. Kahmen of the Technical University of Vienna on *High Precision Engineering and Robotics* and a second one by Dr. Murray Strome, President of PCI Ltd. in Ottawa on *Advanced Remote Sensing*.
- Administrative changes in the Department during the year include the appointment of Dr. G. Lachapelle as Associate Head (Undergraduate Studies) in the Fall of 1990 and Dr. J.A.R. Blais as Associate Head (Graduate Studies and Research) effective July 1, 1991. Mr. Garth Wanamaker became Technical Supervisor in the Department.





A DREAM COME TRUE

On Friday June 15, 1979 the Hon. James Horsman announced in the Alberta Legislature approval of the Civil Engineering Building Extension at The U of C. Since this extension was a condition to the Surveying Engineering programme proposal, the announcement indirectly also indicated approval of the programme. Thus the U of C's bid had won over proposals from the University of Saskatchewan and from the B.C. Institute of Technology, the latter prepared in cooperation with Simon Fraser University. On July 9, 1979 approval for funding of the programme was announced in the form of a \$2.65 million four year programme development grant, after attempts to have the programme jointly funded by the four western provinces remained unsuccessful. Our Faculty was selected to become the *home* for a surveying and mapping education and research center in Western Canada.

Implementation of the third year of the Surveying Engineering programme at Calgary in September 1979 brought to an end a 20 year concerted *drive* by the surveyors of Western Canada for the establishment of such a programme. This development was for most if not all surveying professionals in this part

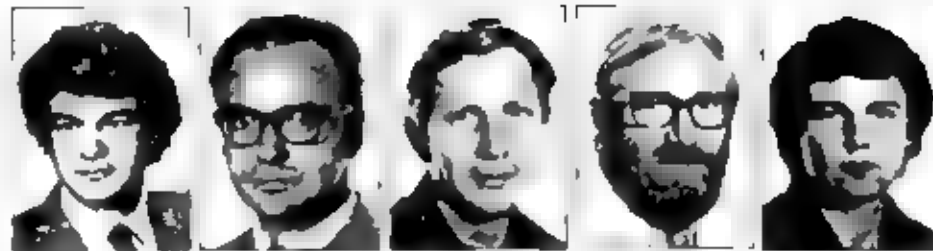


Plate 7.9 The first full-time academic staff in Surveying Engineering 1979-80

of the country a *dream come true* or a *wish come true*, after all those years of promises and disappointments, discussions and negotiations which at times, appeared to be endless and demanded the time and energy of many members of the profession. Some of the many obstacles and detours encountered along the rocky road towards this *dream* are briefly outlined in Appendix J.

Approval of the Surveying Engineering programme proposal in mid June of 1979 was also a very significant event for Dr. E.J. (Ed) Krakiwsky, Professor of Surveying Engineering at the University of New Brunswick (UNB). Ed was involved in the preparation of the proposal during the Summer of 1978 and kept his eyes on the Alberta scene. He knew well that despite the economic boom in the province approval of the programme was by no means guar-

anteed, especially in view of its condition for construction of a Civil Engineering Extension proposed during a period of freeze on all new capital construction which had been instituted by the Alberta Government in 1975. Nevertheless, Ed Krakiwsky decided to leave UNB and move to Calgary, but not before he had secured firm employment with Shearman & Sterling Ltd. as Research Director of Surveying, effective July 1. His arrival coincided almost exactly with the announcement in the Legislature which added joy and excitement to the *homecoming* of the native Calgarian after 17 years of studies, teaching and research at The Ohio State University, OSU, the UNB and the Centre National d'Etudes Spatiales in Toulouse, France.

Approval of the new programme prompted quick action and negotiation between the Head of Civil Engi-

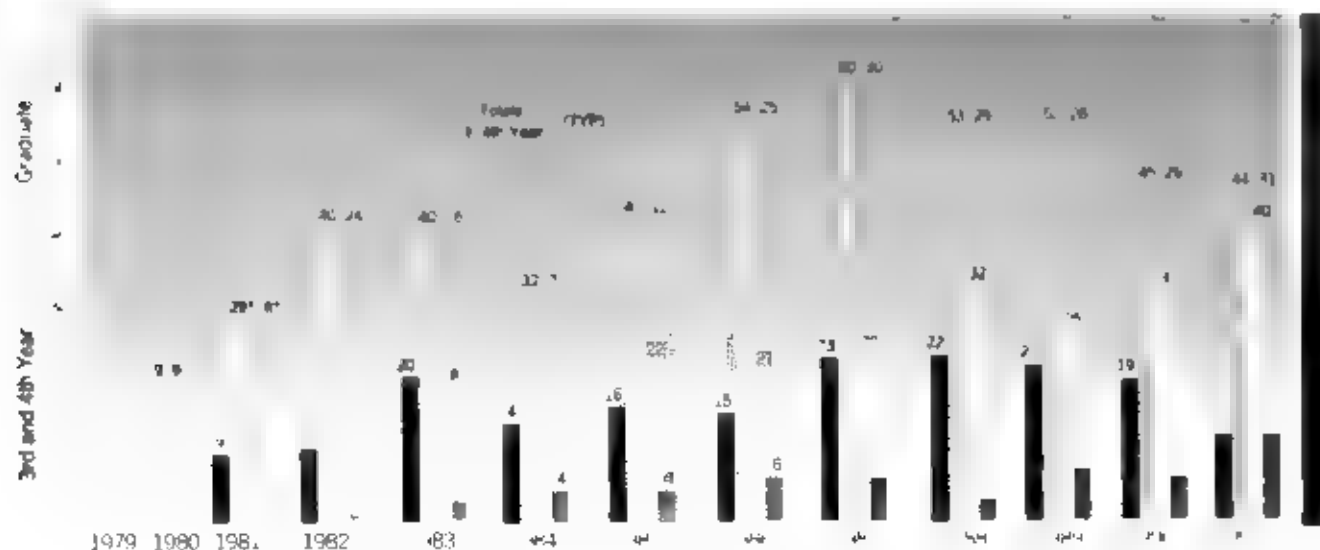


Fig. 7.3 Enrollment and Convocation Statistics for Surveying Engineering 1979-1991


$$f_{k,j}^{\pm} = \frac{1}{2} \left(f_{k,j} + \frac{1}{\epsilon} \left(f_{k,j} - f_{k,j}^{\pm} \right) \right) \quad \text{for } j = 1, \dots, n_k.$$


Journal of Management Studies, 19(1), 67-80.

Redefinition and New Technology in the Surveying Profession

The impact of

[illegible]

A new administration building during the late 1970s together with the building of a new library and helped Ed Krakowski to attract additional staff and students from his previous place of employment. His former PhD student Dr Donald D. Thomson decided during the Spring of 1979 to return to the University as a professor in the West Undergraduate and graduate students also came to

Category from JNB: William H. Kenberg, Peter J. Davis, Gregg, Kenneth Larsen, Michael P. Mepham and Richard J. C. Wong are who knew or were former students of Ed Krakowsky.

The first third year class in Surveying Engineering in September 1979 included some 20 students, 8 of whom were in mixed programmes. In preparation of the programme of such short notice required further

and continued assistance and support from the professor. A number of individuals, mainly from Calgary, were involved during that first academic year as St. John's students, including Dr. Donald D. Thomson and Messrs. Alexander L. H. Thomas, C. Swanby and John R. Adams, the latter of whom was also a former graduate student at UNB. Almost immediately a limited programme of graduate study and research was initiated at the MSU.



The Role of the Professional Surveyor/Surveying Engineer in Industry as part of the Geodetic Seminar on Tuesday, Sept 4, 1979 at the R. Webb unidentified Ron Pawson, Bill Wolff, Dod, Ed Komedy, Jerry Rasnidsori, Alex Hill

level with approximately half a dozen graduate students, some of whom served as graduate teaching assistants and part time sessional instructors, including Michael Mephum and Richard Wong (see Figure 7.3).

Realizing the significance of the contribution by the profession to the institution and approval of the programme proposal, and recognizing the continued support the surveyors of Western Canada could and would provide to the budding Division, Ed Krakivsky, soon after his arrival, established the Surveying Engineering Advisory Committee including key surveying professionals from across Western Canada. Membership of the Committee was complete by the time the Fall session started in September (see Appendix J).

To commemorate the inauguration of the first Surveying Engineering BSc programme in Western Canada



Department Archives

Plate 7.12 During the Students' Awards ceremony at the Seminar Banquet, Sept. 4, 1979, the first Surveying Engineering prizes were awarded. The H. Holtway Scholarship was presented to Gordon Johnson by Norman R. Mattson, current President of the Alberta Land Surveyors' Association. Also the M.R. Scholarship for graduate studies was awarded to William Falkenberg by Douglas Moore, current President of the M.R. Institute. The Shell Canada Scholarship was presented to Mr. Terence L. Farte in absentia by Alex L. Hiltel, Surveying Manager, Shell Canada Resources Ltd.



J.E. Lodwick



C.S. Fraser



T.C. Swanby

Plate 7.13 Further permanent and sessional academic appointments 1980-81.

and at The University of Calgary, the Division Chairman organized a Geomatic Seminar for September 4-5, 1979. This event provided an opportunity to have the Surveying Engineering programme officially opened in the presence of representatives from the surveying industry (see Plates 7.10-7.12).

The day after the seminar, on September 6, the first meeting of the Advisory Committee was held at The U of C with 11 of its industrial members and the staff of the Division in attendance (see Appendix J). The Committee established its terms of reference and agreed to meet twice a year, preferably at least once at The U of C. It has become a tradition in Surveying Engineering at Calgary that the Students' Awards Night is held on the eve of the Fall

annual meeting of the Advisory Committee.

With the third year of the programme successfully launched, the Chairman turned his attention to finding additional manpower. He succeeded in attracting

Drs. Graham D. Lodwick and Clive S. Fraser, effective July 1, 1980 and February 1, 1981 respectively, thereby completing the group

of original seven (Anderson, Blais, Fraser, Krakivsky, Lodwick, Schwarz and Teskey) who laid the foundation for the Surveying Engineering Department at The University of Calgary.

The Fall of 1980 saw the inaugural fourth year Surveying Engineering class and 7 students registered in MSc programmes (see Figure 7.3). To help carry the increased teaching load, Tom Swanby's contract as Sessional Instructor was renewed and J.T. Lockhart was hired for the session, the first of whom was to serve the Division/Department and contribute to its development during



Plate 7.14 The Surveying Engineering Graduates with four of the Academic Staff. Left to Right: R.E. Anderson, A.F. Mackenzie, F.E. Green, E. Krakivsky, R.D. Ruiz, D.A.G. Arden, A.R. Blais, K.P. Schwarz, June 1982.

Appointed Assoc. Prof. Appointed Assis. Prof.

the next 10 years. The full-time academic staff of the Division was successful in the first round of applications to NSERC and obtained grants totaling approximately \$150,000 in addition to a number of grants and equipment donations from industry (see Figure 7.4).

The 1981 Spring convocation saw the first 8 Surveying Engineering students receive their BSc degrees from The University of Calgary (see Figure 7.3) with one additional graduate at the November convocation.



Plate 7.4 The first MSc graduate in Surveying Engineering, Richard V.C. Wong, Fall Convocation 1982.

It was during 1981-82 that the new Surveying Engineering programme was accredited by the Canadian Council of Professional Engineers (CCPE). A further important milestone in the development of the Division into a full-fledged undergraduate, graduate and research department was the review carried out under the direction of Dr. James B. Hyne, Dean of the Faculty of Graduate Studies at The U of C. The review included on-campus examiners and an external reviewer, Dr. L.A. Jotila, Professor of Geodetic Science at The Ohio State University. Dr. Jotila visited the Division from January 20-23, 1982 and submitted his report to Dean Hyne's Committee on February 19, in which he stated that 'The U of C has one of the strongest undergraduate programmes in Surveying Engineering in the Western Hemisphere'. This review resulted in a recommendation that the Division be given departmental status and that it be allowed to offer graduate programmes at the Masters and Doctoral levels. During the next year a

Appointed Part-time Sessional Instructor & Research Associate Sept. 1982, Professor Jan. 1983

formal proposal for the expansion of the graduate programme in Surveying Engineering received institutional approval and was submitted to DAEM for funding. Consideration of departmental status for the Division was delayed until the graduate programme was approved and funded.

Construction of the F Block was completed in July 1982 which allowed Civil Engineering to vacate its old home. Consequently, the Division was able to move into newly renovated space during the Fall of 1982. The additional space also allowed establishment of new laboratories for undergraduate and graduate teaching and research. The new Survey Engineering Observatory on the roof of the F Block also became available. New sessional and research staff joining the Division in the Fall of 1982 included Mr. Michael A. Chapman and Dr. Gerard Lachapelle. The first MSc student from Surveying Engineering, Richard Wong, received his degree at the 1982 Fall Convocation (see Plate 7.6). Research funding from external sources and equipment donations helped to get research into high gear in the Fall of 1982. Amongst the donations, the most



Mr. Michael A. Chapman



Dr. Gerard Lachapelle



Mr. M. N. Nakiboglu

Plate 7.5 New Surveying Engineering staff, 1982-83

notable one during 1982-83 was the Litton Inertial navigation system from Litton Guidance and Control Systems to Dr. K.P. Schwarz (see Plate 7.17).

A highlight of the academic year was the assessment of the Division and its programme since it was the fourth and final year of the programme development grant. After a thorough review, DAEM at the recommendation of the University decided to incorporate the special grant into the base budget of the Institution thereby acknowledging the excellent job the Chairman and the staff of the Division had done in establishing Surveying Engineering at The U of C.

Another highlight of the academic year was the logo design by members of the Surveying Students Society for the 1986 FIG Congress scheduled for Toronto. The logo was so original and innovative that it won the design contest (see Plate 7.18).

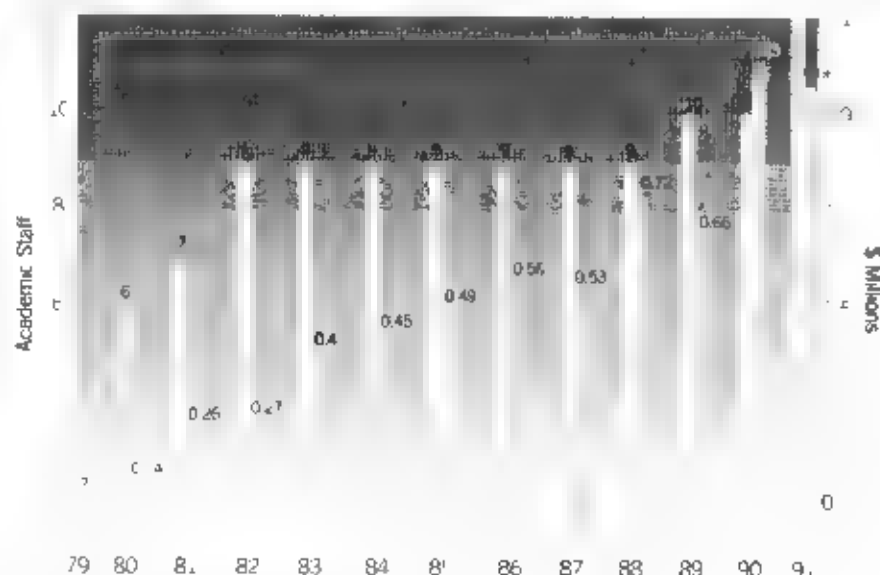


Fig. 7.4 Full-time Academic Staff and Annual External Research Funding Surveying Engineering 1979-1990

Appointed Part-time Sessional Instructor & Research Associate Sept. 1982, Professor Jan. 1983



a The Ribbon-Cutting by Mr. Bill Waterhouse, RMC Liaison Guidance and Control Systems, California, aided by Dean Tom Balfour with Division Chairman Ed Krakiwsky. C standing by



d A tour of the laboratory and comments from Mr. Waterhouse about the \$75,000 equipment donation and then reasons for selecting The U of C over all U.S. universities as recipient of the **grandfather** dual in-line navigator systems making it the only Surveying Engineering School with a well-equipped inertial surveying laboratory at the time

Plate 7.17 Official Opening of the Inertial Surveying Laboratory and Dedication of the UConn Inertial Survey System Tuesday May 10, 1983

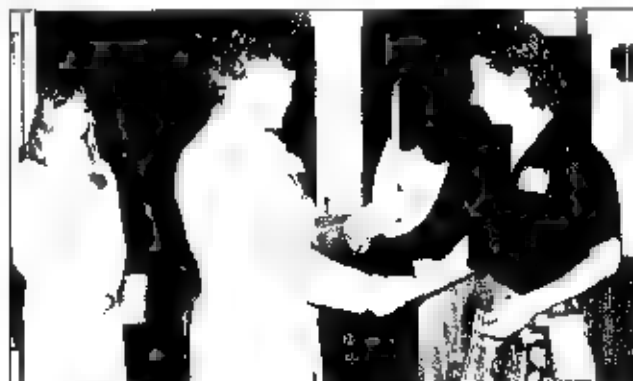


Plate 7.18 Dr. E. Krakiwsky presenting the Federation internationale Geometres Plaque to Dimitri Katsaris in recognition of the winning logo design by the Surveying Engineering Students for FIG 86, held in Toronto, with Diane Allen, President of the Survey Students Society, presiding

At its June 16, 1983 meeting the Department of Civil Engineering passed a motion recommending departmental status for the Division, a recommendation approved by EFC on September 29, 1983. Before going on sabbatical leave on July 1, 1983, Dr. Krakiwsky hired Dr. Mele Nakbogal effective August 1983. Clive Fraser resigned and left in December 1983.

After returning from his sabbatical year, Ed Krakiwsky succeeded in having the Bureau of Surveying and Mapping, Alberta Energy and Natural Resources, commit funds for an endowed Professorship in digital mapping and spatial data management in the form of six annual instalments of

Appointed Assoc. Prof.

\$150,000, 1985-90 together with \$0.47 million in government matching grants for capital equipment donations received by Surveying Engineering during 1984-85. The long-term result of this Professorship was the establishment of the Geomatics Group which has become one of the main research groups in Surveying Engineering.

During the 1985-86 academic year annual external research funding reached the \$0.5 million mark for the first time. A major NSERC equipment grant to Dr. K. P. Schwarz allowed acquisition of a Litton LTN 90/100 inertial navigation system (strap-down). Cash donations from industry provided the resources to acquire two Trimble 4000S GPS satellite receivers thereby providing facilities to the Surveying Engineering Research group at Calgary which were second to none at any University around the globe. The first MEng degrees in Surveying Engineering at The U of C were awarded in 1985 to H. Ayers and R. Ferland while the first PhD grad (and



Plate 7.19 Mr. Parnell of Underhill & Underhill Surveying Eng. Consultants, Vancouver just before the Ribbon-Cutting for the Official Opening of the vAX/graphics Laboratory, with Dr. Graham D. Lodwick lending a hand November 1984

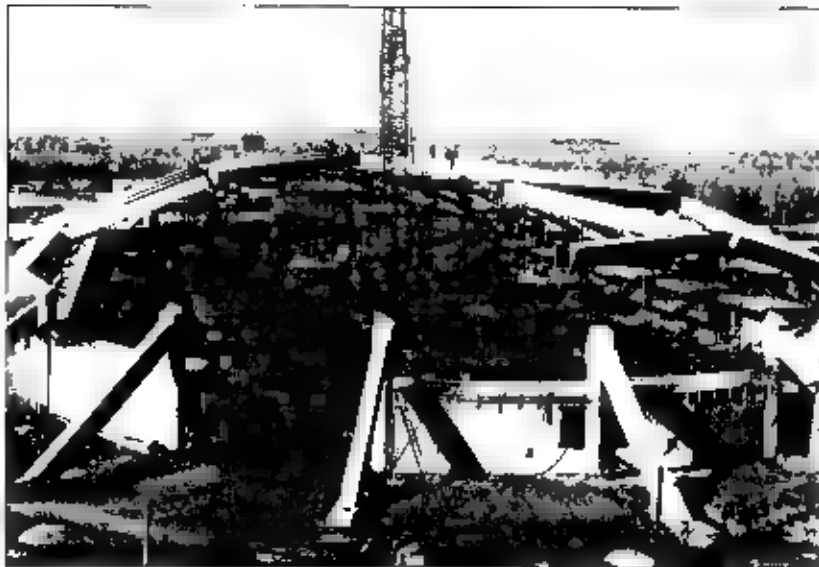


Figure 1. The Olympic Speedskating Oval, Calgary, Alberta, 1988.

The Division Chairman and staff were tired of waiting for funding approval by DAEM for the Surveying Engineering graduate programme expansion which had departmental status for the Division coupled to it. Ed Krakowsky calculated that it would take \$1.7 million in operating funds and an additional \$0.83 million for equipment to bring the Division up to critical mass for offering graduate programmes at all levels and in a number of specializations. He initiated a fund raising drive which resulted in donations of \$2.7 million for operating funds and \$1.1 million for new equipment exceeding both estimated requirements substantially. The surveying industry's strong support was, once again, the trigger which resulted in the approval by the Deputy Minister of AEM of the University's recommendation for departmental status for the Division, a decision which was implemented effective November 20, 1986.

from the Division was A.A. Vassiliou (see Plate 7.28).

The Division Chairman and staff were tired of waiting for funding approval by DAEM for the Surveying Engineering graduate programme expansion which had departmental status for the Division coupled to it. Ed Krakowsky calculated that it would take \$1.7 million in operating funds and an additional \$0.83 million for equipment to bring the Division up to critical mass for offering graduate programmes at all levels and in a number of specializations. He initiated a fund raising drive which resulted in donations of \$2.7 million for operating funds and \$1.1 million for new equipment exceeding both estimated requirements substantially. The surveying industry's strong support was, once again, the trigger which resulted in the approval by the Deputy Minister of AEM of the University's recommendation for departmental status for the Division, a decision which was implemented effective November 20, 1986.

A significant development for the Department of Surveying Engineering was the construction of the Olympic Speedskating Oval, 1985-87. From the outset it was decided to monitor the long-term deflection behaviour of the unusual roof struc-

ture due to creep and shrinkage and compare such data with analytical predictions. The Oval has since become a *Precise Engineering and Deformation Surveys Laboratory*, the only such laboratory in the world (see Plate 7.20).

Staff changes during 1987 included

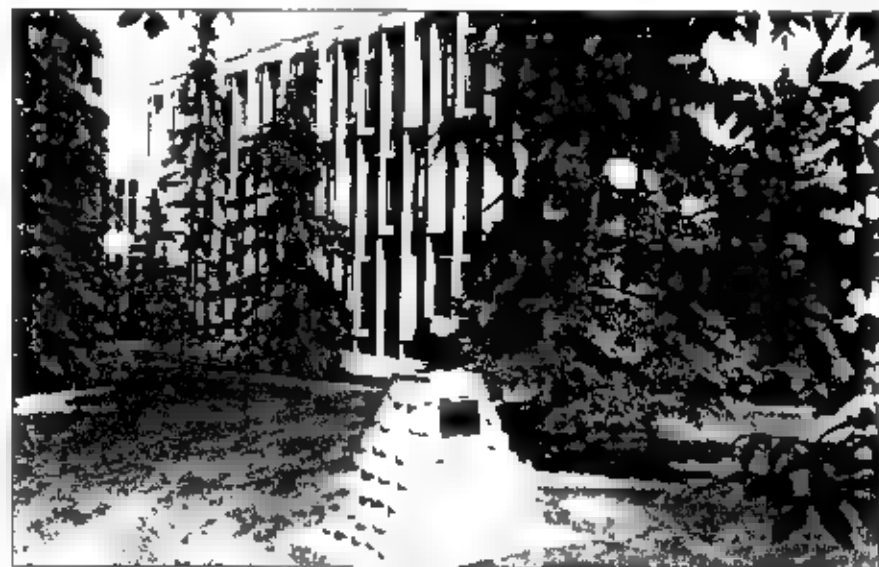


Figure 2. One of the most extensively deflected spots on Earth, the Olympic Speedskating Oval, Calgary, Alberta, 1988. The building is the most extensively deflected spot on Earth, as measured by the Alberta Precision Engineering and Deformation Surveys Laboratory. The building is the most extensively deflected spot on Earth, as measured by the Alberta Precision Engineering and Deformation Surveys Laboratory.

A.A. Vassiliou (see Plate 7.28).



Figure 3. A surveying instrument, likely a theodolite or total station, mounted on a tripod. The person is looking through the eyepiece.



Plate 22 The Hon. F.W. Crani, Minister, with Bill Teskey after the unveiling ceremony December 1987. The monument is a gift to the Province of Alberta from the Association of Professional Engineers, Geoscientists and Geophysicists of Alberta (APEGGA) and the Surveying and Mapping Society of Alberta (SMSA) in recognition of the valuable contribution of the surveying profession to the development of Western Canada.

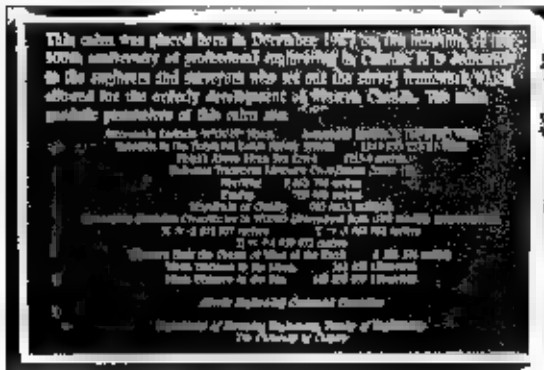


Plate 23 The plaque on the south face of the monument.

a contract which was changed to a tenure track appointment on July 1, 1989. M.A. Chapman, who joined the Department in 1982 as Research Associate and Sessional Instructor and became a full-time teaching faculty member in 1984, finished his PhD work and was appointed Associate Professor on May 1, 1989. In addition, Dr. Ian K. Crain was hired as Associate Professor of digital mapping and spatial data management effective August 1, 1989, replacing Vincent Robinson, who had been appointed on January 1, 1987 and resigned in August 1988.

After returning from his PhD studies at Stuttgart in the Spring of 1987, Bill Teskey took on an engineering centennial project funded by a \$3000 grant from the Association of Professional Engineers, Geoscientists and Geophysicists of Alberta (APEGGA). He decided to build a 1.8 m high stone

cairn similar to those used to define the Canada-U.S.A. international boundary, with a metal globe on top. He also decided to make the location of this cairn one of the most extensively defined spots on earth (see Plates 7.21-7.23).

A second highlight of the 1987-88 academic year was the establishment of the Industrial Alignment

Project (IAP), jointly undertaken by four members of the academic staff (Drs. Schwarz, Teskey, Siders and Chapman) and 14 industrial partners from Western Canada and NSERC. The project uses precise engineering survey techniques for the alignment and positioning of transmission and distribution system components, machines and various industrial equipment to eliminate misalignment and associated wear, vibration and possible failure and to establish and/or incorporate observation techniques and data gathering methods for preventive maintenance (see Plate 7.24).

On June 30, 1989, after 10 years of dynamic leadership as Chairman/Head of the Division/Department of Surveying Engineering, Ed Krakiwsky stepped down and took a sabbatical leave, with Dr. Gerard Lachapelle serving as Acting Head for a six-month period before Dr. Klaus-Peter Schwarz assumed the headship on Jan. 1, 1990. Two long-time members of the Department, Ted Anderson and Michael Mephram, the latter after completing his PhD degree, left after 10 years of valuable service and contributions to the building of the Division and the Department.

An excellent example of industry-university cooperation and technology transfer and an interesting application of the Department's expertise



Plate 7.24 The Industrial Alignment Project (IAP), initiated by K.F. Schwarz, W.F. Teskey and S. Mughni, through an NSERC Cooperative Research and Development (CRD) Grant, is aimed at developing survey techniques for the alignment and positioning of machines and equipment to eliminate misalignments and associated vibrations and wear. Funding for IAP from Nov. '89 to Nov. '91 is \$30,500. Illustration comes from NSERC and 14 industrial partners including Alcan, Gas City, Inc., Alberta Natural Gas, Arnold Petroleum Canada, Canadian National Railways, Canadian Pacific Railway, Canada, BSCD, Calgary Canada, Nova Scotia Power Corp. & Suncor and TransCanada Pipelines, with Kadon Electro-Mechanical Services acting as principal coordinating partner. Photo: Michael C. Siders. Bill F. Teskey, S. Mughni, President of Kadon and Michael A. Chapman discussing the IAP alignment results from the testing designed and built by Kadon, 1991.



Plate 7.25 The first woman to receive a PhD in Surveying Engineering in Canada, Elinede Thekua Knickmeyer, accepting the \$2,000 H. Montz Graduate Award in Surveying Engineering from Department Head K.P. Schwarz at the Students Awards Night, Oct. 19, 1990 in the Faculty Club, MacEwen Centre.

in inertia technology is a project on monitoring pipelines in which a plug containing the necessary monitoring equipment and referred to as a pipeline pig, is propelled along the line by the oil or gas pressure. The pig collects data which, when evaluated, allows determination of critical bends and locations of possible fracture in the pipe. The equipment is built by a Calgary company, Pulsesearch Consolidated Technology (see Plate 7.27).

Other highlights and significant activities of the Division/Department

during 1979-1991 include

- the continuing involvement of industry with the Surveying Engineering programme and Department at The U of C through the Advisory Committee and through more than a dozen major scholarships and awards to undergraduate and graduate students in Surveying Engineering;
- the annual survey camp, held in Kananaskis Country at which stu-

dents and staff interact in pleasant healthy surroundings

- the organization of the GPS/INS Conferences in Calgary or Banff, a quadrennial event which has become the place for experts from around the globe to present their latest research results, discuss problems and relax in the magnificent surroundings of the Rocky Mountains;
- the development of specialization in cadastral studies and the Dominion Lands Survey System, DLS, introduced in Western Canada in 1871 (see Plate 7.26);

Significant to the Department's long-term development were the discussions initiated in 1991 concerning a change in name. After Departmental Council and EFC gave their approval on Nov. 20, 1991 and March 11, 1992, respectively, the name change from Dept. of Surveying Engineering to *Dept. of Geomatics Engineering* became official upon GFC's approval on June 11, 1992.

The present administrative structure and staff of the Department, the administrative history of the Division/Department, outstanding awards and prizes won by staff and students and the name of a full-time permanent academic and support staff with a service period of more than a year are indicated in Tables 7.1-7.4 at the end of Chapter VII, respectively.



Plate 7.26 The Dominion Lands Survey System, DLS, introduced the familiar pattern of townships, sections and quarter sections in Western Canada in 1871. Courses on boundary surveys and land title registration are offered under Cadastral Studies in Surveying Engineering as part of the qualifications leading to registration as a professional land surveyor. Four members who have contributed to the development of this important area of specialization in the Department are Tom Swarby, Alex Hittel, Dave Jsther and Bill Teskey, the latter of whom spearheaded the writing of a set of lecture notes on the DLS System. Shown here are, left to right, Tom C. Swarby, Alex L. Hittel, Alec C. McEwen, the newly appointed Professor of Cadastral Studies and Bill F. Teskey.



Plate 7.27 Transfer of inertia technology from Surveying Engineering resulted in a so-called pipeline pig produced by Pulsesearch Consolidated Technology Co. of Calgary with the collaboration of Dr. K.P. Schwarz. The inertial equipment is fitted into a plug which is driven along the pipeline by the pressure of the oil or gas which is being transported. The data obtained helps to determine critical bends or corrosion spots along the line which can then be repaired before failure and environmental damage occurs. The picture shows a 26 inch (66 cm) diameter model of the Pulsesearch pig with the president of the company, Mr. John R. Adams and Dr. K.P. Schwarz inspecting the device. 1991



From left: MSc graduate in Surveying Engineering at The U of C, Theano N. Teskey, flanked by MSc graduates Anthony A. Vassiliou (L) and [Name] to become the first PhD graduate from Surveying Engineering at Calgary in 1986 and the latter joining the academic staff of the [Name] City, June 1, 1984.

Table 7.1 STAFF AND ADMINISTRATION — 1990-91
DEPARTMENT OF SURVEYING ENGINEERING

| | |
|--|--|
| HEAD Dr. Schwarz, K.P.
Secretary: Miss Anderson, Marguerite J. | ACADEMIC STAFF
Dr. Blais, J.A.R.
Dr. Cannon, M.E. (since 91.05.01)
Dr. Chapman, M.A.
Dr. Crain, I.K.
Dr. Gong, P.
Dr. Krakiwsky, E.J.
Dr. Lachapelle, G.
Dr. Lodwick, G.D. (till 91.08.18)
Dr. McEwen, A.C. (since 91.01.01)
Dr. Schwarz, K.P.
Dr. Sideris, M.G.
Dr. Teskey, W.F. |
| ASSOCIATE HEAD Dr. Lachapelle, G.
(Undergraduate Studies) | |
| ASSOCIATE HEAD Dr. Blais, J.A.R.
(Graduate Studies and Research) | |
| SECRETARIAL STAFF
Mrs. Gehring, Anne
Mrs. Kelly, Sandy L.
Mrs. Lai, Julia
Ms. Leung, Mei Lan (Julie) | |
| TECHNICAL STAFF
Supervisor: Mr. Wanamaker, Garth
Mr. Beaulieu, Paul J.
Mr. Goss, Rob (till 90.11.16)
Mr. Robinson, Keith (since 91.01.07)
Mr. Szarmes, Michael | RESEARCH ASSOCIATES/ASSISTANTS AND PDF's
Mr. Cosandier, Darren
Mr. He, Kewen
Dr. Kama, H.
Dr. Krynsk, Jan
Mr. Martell, Hugh
Dr. Wei, Ming
Prof. Zhen, R. |

Table 7.2 TIME LINE OF ADMINISTRATION - 1979-1991
DEPARTMENT OF SURVEYING ENGINEERING

| | Year | Administrator/Head | Departmental Secretary | Associate Head(s) | Technical Supervisor |
|-------------------------------|------|--|--|--|----------------------|
| Division in Civil Engineering | 1979 | E.J. Krakiwsky
(07.01)
Division Chairman | Sheila Diewold
(07.01)
Phyllis Austin
(07.04) | | |
| | 1983 | K.P. Schwarz
Acting
(07.01) | Maxine Madison
(07.04) | | |
| | 1984 | E.J. Krakiwsky
Chairman
(07.01) | Maxine Madison | | |
| Autonomous Department | 1986 | E.J. Krakiwsky
Head
(11.20) | Maxine Madison | | |
| | 1989 | G. Lachapelle
Acting
(07.01) | Marguerite Anderson
(05.01) | | |
| | 1990 | K.P. Schwarz
Head
(01.01) | Marguerite Anderson | G. Lachapelle
(Undergraduate Studies)
(09.01) | |
| | 1991 | K.P. Schwarz | Marguerite Anderson | G. Lachapelle
J.A.R. Blais
(Grad. Studies & Research)
(07.01) | Garth Wanamaker |

Table 7.3 STUDENT AND STAFF AWARDS, PRIZES AND ACHIEVEMENTS
DEPARTMENT OF SURVEYING ENGINEERING, 1979-93

I. Undergraduate Scholarship, Medal and Prize Winners

(a) Association of Professional Engineers, Geologists and Geophysicists of Alberta Gold Medals (1981-91)

| | | | | | |
|---------------------|--------------------|--------------------|-----------------------|----------------------|--------------------|
| 1981 Schleppe, J.B. | 1983 Wanless, B.A. | 1985 Pointon, K.W. | 1988 Sutherland, D.G. | 1991 Hare, R.M. | 1993 Bullock, J.B. |
| 1982 Arden, D.A.G. | 1984 Watkins, S.J. | 1987 Bayly, D.A. | 1989 Stupan, P.M. | 1992 Hinkelman, J.P. | |

(b) J.H. Holloway Scholarship (J of C Students)

| | |
|----------------------|-----------------------|
| 1979 Johnson, G.W. | 1984 Pointon, K.W. |
| 1980 Schleppe, J.B. | 1985 Ratchinsky, K.W. |
| 1981 MacKenzie, A.P. | 1986 Tam, A.P. |
| 1982 English, J.J. | 1987 L. S.H. |
| 1983 Bates, P.T. | 1988 Wilson, E. |

(c) Walker, Newby and Associates Ltd. Scholarship

| | | |
|--------------------|----------------------|-------------------------|
| 1981 Eddy, P.R. | 1986 Bayly, D.A. | 1990 DiGiovanni, R.L. |
| 1982 Jyall, R.L. | 1987 Smith, G.D. | 1991 Rosnes, J.D. |
| 1983 Pointon, K.W. | 1988 Contois, R.J.M. | 1992 Desrochers, M.A.T. |
| 1984 Moss, D.L. | 1989 Hume, A.J. | 1993 Gray, T.J. |
| 1985 Riecken, R.K. | | |

(d) The McElhanney Scholarship

| |
|-----------------------|
| 1985 Williams, S.P. |
| 1986 Martell, H.E. |
| 1987 Sutherland, D.G. |
| 1988 Stupan, P.M. |

(e) Wild Leitz Canada Ltd. Scholarship

| |
|-----------------------|
| 1983 Laplante, L.C. |
| 1984 Chong, G. |
| 1985 Martell, H.E. |
| 1986 Sutherland, D.G. |

(f) Manitoba Land Surveyors Award

| | |
|------------------------|----------------------|
| 1983 Bossenmaier, S.J. | 1988 Standing, P.G. |
| 1984 Stevens, D.T. | 1990 Hinkelman, J.P. |
| 1985 Hamelin, R.J. | 1991 Hinkelman, J.P. |
| 1987 Dyck, G.J. | |

(g) British Columbia Land Surveyors Award

| | |
|-----------------------|-------------------|
| 1981 Porter, T.B. | 1985 Tam, A.P. |
| 1982 Bates, P.T. | 1986 Sansom, B.D. |
| 1983 Hoerbarger, E.A. | 1987 Wilson, E.J. |

(h) Tony Neidermayer Memorial Bursary

| | |
|--------------------|--------------------|
| 1982 Wanless, B.A. | 1987 Contois, R.J. |
| 1983 Pointon, K.W. | 1989 Contois, R.J. |
| 1985 L. S.H. | |

(i) Saskatchewan Land Surveyors Association Award

| | |
|-------------------|------------------|
| 1983 Moss, D.L. | 1987 Yeung, S.H. |
| 1985 Parker, B.F. | 1988 Szabo, D.J. |
| 1986 Ling, A. | 1989 Wong, K. |

(j) Prairie Surveys Ltd. Award

| | |
|-------------------|-----------------------|
| 1982 Fraser, B.W. | 1984 Hoerbarger, E.A. |
| 1983 Woods, M.V. | |

(k) S.P. Williams Memorial Award

| |
|-------------------|
| 1988 Carter, J.M. |
| 1989 Notoia, E.L. |
| 1990 Lloyd, M. |

(l) Leica Canada Inc. Scholarship

| |
|-----------------------|
| 1990 DiGiovanni, R.L. |
| 1991 Bullock, J.B. |

(m) Shell Canada Scholarship

| | |
|--------------------|---------------------|
| 1980 Green, S.C. | 1982 Neufeldt, D.W. |
| 1981 Wanless, B.A. | 1983 Neufeldt, D.W. |

(n) Others

| | | | |
|-----------------------------|--|-------------------------|---|
| 1979 Arden, D.A.G. | Robert B. Raugh Memorial Bursary | 1989 Hare, R.M. | Trajan and Florica Nitescu Scholarship |
| 1982 Pointon, K.W. | Canadian Bechtel Ltd. Bursary | 1991 Bullock, J.B. | Cactus Drilling Corp. Ltd. Bursary |
| 1983 Neufeldt, D.W. | Can. Gas Processors Assoc. Book Prize | Dumka, M.I. | Petroleum Society of CIM (Calgary Section) Sch. |
| Watkins (nee Lebbert), S.J. | Canterra Energy Ltd. Scholarship | Hare, R.M. | Cactus Drilling Corp. Ltd. Bursary |
| 1985 Sutherland, D.G. | Transalta Utilities Memorial Scholarship | Joyd, M. | EIC Engineering Student of the Year Medal |
| 1986 L. S.H. | Domie Petroleum Ltd. Bursary | Bullock, J.B. | Petroleum Society of CIM (Calgary Section) Sch. |
| Sutherland, D.G. | EIC Calgary Branch Scholarship | 1992 Szarmes, M.C. | W.G. (Bill) Howard Memorial Foundation Award |
| 1987 Stupan, P.M. | Trotter & Morton Ltd. W. Watson Bursary | 1993 Wigglesworth, K.B. | Alberta Heritage Louise McKinney Sch. |
| | | | The McElhanney Scholarship |

II Graduate Scholarship, Medal and Prize Winners

(a) NRC/NSERC Postgraduate Scholarship

| | | | | | |
|-------------------|--------------------|--------------------|-------------------|--------------------|---------------|
| 1980 Wong, R v C. | 1984 Wanless, B.A. | 1986 Pointon, K.W. | 1991 Larouche, C. | 1991 Obidowski, R. | 1992 Lu, G. |
| 1981 Wong, R v C. | 1985 Wanless, B.A. | 1987 Pointon, K.W. | L. S.H. | 1992 Larouche, C. | Obidowski, R. |

(a) Walker, Newby & Associates Ltd. Graduate Scholarship

| |
|--------------------|
| 1983 Paine, S. |
| 1984 Wanless, B.A. |
| 1985 Mephram, M.P. |

| |
|--------------------|
| 1986 Mephram, M.P. |
| 1987 Karimi, H.A. |
| 1988 Schultz, F.M. |

| |
|---------------------|
| 1989 Stadelmann, M. |
| 1990 Townsend, B. |
| 1992 Larouche, C. |

(c) H. Moritz Graduate Scholarship

| |
|-----------------------|
| 1989 Knickmeyer, E.T. |
| 1990 Lepucha, D. |
| 1991 Lu, Gang |
| 1992 Czompo, J. |

(d) J.M.R. Instruments Ltd. Award

| |
|-----------------------|
| 1980 Falkenberg, W.H. |
| 1981 Mephram, M.P. |
| Gauthier, M. |

| |
|----------------------|
| 1981 Wong, R v C. |
| 1982 MacKenzie, A.P. |
| 1983 MacKenzie, A.P. |

(e) Others

| | | | | | |
|------|---------------|--------------------------------------|------|---------------|---|
| 1984 | Bulfielt, B. | EDO Canada Ltd. Scholarship | 1989 | Schultz, F.M. | Chrysalis Scholarship For Women |
| 1985 | Wong, R v.C. | EDO Canada Ltd. Scholarship | 1990 | Cannon, M.E. | Best Student Paper Award of ION |
| 1986 | Cannon, M.E. | EDO Canada Ltd. Scholarship | | Cannon, M.E. | W. Killam Memorial Scholarship |
| | Rauhut, A. | Delta, Kappa, Gamma World Fellowship | | Gao, Y. | ION Best Student Paper Award |
| 1987 | Pointon, K.W. | EDO Canada Ltd. Scholarship | | | Province of Alberta Graduate Fellowship |
| | Rauhut, A. | Delta, Kappa, Gamma World Fellowship | 1991 | Cannon, M.E. | FIG Congress Prize |
| 1988 | Rauhut, A. | Delta, Kappa, Gamma World Fellowship | | Czompo, J. | ION Best Student Paper Award |
| | Goldfarb, J. | Analytic Surveys Scholarship | | Gao, Y. | ION Best Student Paper Award |
| | Cannon, M.E. | W. Killam Memorial Scholarship | | Gao, Y. | Province of Alberta Graduate Fellowship |
| 1989 | Cannon, M.E. | W. Killam Memorial Scholarship | | Lu, G. | ION Best Student Paper Award |
| | Wei, M. | NSERC Int. Research Fellowship | 1992 | Czompo, J. | Alberta Research Council Scholarship |
| | Sudibjo, E. | NTERA Technologies Ltd. Scholarship | | Larouche, G. | Fonds pour la Formation de Chercheurs & l'Aide à la Recherche |
| | Bavly, D.A. | Alberta Research Council Scholarship | | | |

III. Staff Awards and Achievements

| | | | | | |
|------|-----------------|--|------|---------------------------------|--|
| 1980 | Schwarz, K.P. | Kenting Award | 1989 | Blais, J.A.R., et al | Best Poster Presentation Award, Kyoto, Japan |
| 1980 | Blais, J.A.R. | Certificate of Excellence, Soc. of Tech. Publ. | | | |
| 1981 | Fraser, C.S. | IV Talbert Abrams Award from the Am. Soc. Photogrammetry | 1990 | Blais, J.A.R. and Chapman, M.A. | Interra Kenting Award |
| | | Senior Heiskanen Award from Ohio State University | | Lachapelle, G. | Kenting Award |
| 1982 | Krakiwsky, E.J. | 'Geodesy: The Concepts' North-Holland | | Lachapelle, G. | Prix Fond Joncas |
| | | 2nd ed. 1986, CISM Presidential Award | | Krakiwsky, E.J. | National Lecturer for Canadian Society For Civil Engineering |
| 1984 | Krakiwsky, E.J. | 'Estimation and Spectral Analysis' U of C Press, 1988 | 1991 | Cannon, M.E. | NSERC Women's Faculty Award |
| 1988 | Blais, J.A.R. | Telefix Award | | Cannon, M.E. | Telefix Award |
| 1988 | Lachapelle, G. | | | | |

Table 7.4 LIST OF ACADEMIC AND SUPPORT STAFF — 1979-91
DEPARTMENT OF SURVEYING ENGINEERING

ACADEMIC STAFF

| | |
|-----------------|--------------|
| Anderson, E.G. | 1980-1989 |
| Blais, J.A.R. | 1979-present |
| Cannon, M.E. | 1991-present |
| Chapman, M.A. | 1982-present |
| Cranfield, K. | 1989-1992 |
| Fraser, C.S. | 1981-1983 |
| Gong, P. | 1991-present |
| Krakiwsky, E.J. | 1979-present |
| Lachapelle, G. | 1988-present |
| Lodwick, G.D. | 1980-1991 |
| McEwen, A.C. | 1991-present |
| Nakiboglu, M. | 1983-1987 |
| Robinson, V. | 1987-1988 |
| Schwarz, K.P. | 1980-present |
| Sideris, M.G. | 1988-present |
| Swanby, T.C. | 1980-1990 |
| Teskey, W.F. | 1980-present |

SUPPORT STAFF

Secretaria

| | |
|---------------|--------------|
| Anderson, M. | 1989-present |
| Austin, P. | 1979-1983 |
| Gehring, A. | 1987-present |
| Hortsbaum, N. | 1982-1989 |
| Kelly, S. | 1990-present |
| Leung, J. | 1987-present |
| Madison, M. | 1983-1989 |
| Millar, G. | 1979-1990 |
| Organ, E. | 1980-1986 |
| Seifert, S. | 1986-1987 |
| Tod, M. | 1980-1987 |

Technical

| | |
|---------------|--------------|
| Beaulieu, P. | 1988-present |
| Goss, R. | 1979-1990 |
| Robinson, K. | 1991-present |
| Skea, D. | 1982-1984 |
| Szarmes, M. | 1987-present |
| Wanamaker, G. | 1985-present |
| Wentzel, J. | 1982-1987 |



a The Surveying Engineering team at the White Heather Curling Rink in N.E. Calgary. L. to R. Holger Schade exchange student from Stuttgart (identified hidden behind Holger), Joe Balfre, David Hardwicke crouching, and Leslie Eng — Jan. 2, 1989.



b The Surveying Engineering team involved in one of the Frosh Week fun activities, Tug-o-War, on the lawn west of the E. Lecture Theatres. L. to R. Tony Tubman (identified, not clearly visible), Mark Kocher, David Letkeman, Victor Hut on his back, Edwin Wilson with sunglasses, and Mike Hoogstraat. Nancy Zender (left most spectator, Student Affairs) is observing the proceedings. Sept. 1988.

Plate 7.29 — Surveying Engineering student activities.

POSTSCRIPT

As promised in the Epilogue to Chapter I the whirl-wind tour of Faculty highlights through the period 1957-1993 was followed by trips along the five *departmental roads*. Each of these side roads is jam-packed with *attractions* related to student and staff activities characteristic of the specific discipline. Travel along these pathways was, therefore, slower where time was taken to study and elaborate on the details of significant developments and events and visit with their star players. The trips were enjoyable and relaxing and seemed to get longer as travel progressed.

Now that these visits to the Faculty's past and the accompanying *travel-diary* are completed, it's time for reflection and contemplation. Time to ask what has been accomplished or achieved. For the writer, many of the sites were familiar, bringing back fond and faded memories. The same experience would hold for many of the Faculty's pre-1991 graduands and for most of the staff who celebrated the silver anniversary in the Faculty or who had left or retired prior to 1991, after years of service.

This anniversary volume, however, was not written only for pre-1991 students and staff in Engineering at Calgary. It was also intended for and was meant to be consulted by anyone who has an interest in the history of engineering schools and their development in western Canada. The details with which the material is presented, with numerous photographs, figures, tables and appendices, makes this book into a veritable mosaic of the Faculty's beginnings, its explosive growth and its transformation into a globally recognized centre of engineering education and research. This impressive feat was achieved within a few short years, an accomplishment the planning and execution of which is a unique and exciting story which could, and likely will, be of interest to historians and

designers and administrators of universities, anywhere and at anytime.

As a silver anniversary volume, the book is perceived to be treating a 25 year period, a time span which may or may not be significant in the history of an institution. Certainly, for schools and universities which are centuries old, another 25 years will normally be considered as insignificant in western Canada, however, where in 1991 institutional histories were normally under 100 years, a quarter century could represent a major portion of an organization's existence and could, therefore, be quite significant.

The *paramount* and *unique* significance to the Faculty's history of the third of a century treated in this book is, of course, due to the fact that it is the *first* and *entire* period of its existence. Thus, it encompasses the school's birth, youth and years of rapid development which normally include its most exciting and dynamic events and periods. The numerous firsts, highlights and decisive moments along the road towards maturity are observed and recorded with as much interest and pride as a child's first wobbly steps, first words and initial achievements are celebrated by the parents.

This pre-silver-anniversary period is significant also when measured against the life and career spans of the Faculty's staff. Many of them who celebrated this anniversary or had retired shortly before it joined the *Calgary Engineering Team* as young engineering or technical professionals. They spent their youth and a large part or all of their career in building this Faculty and its departments while establishing their family environment and/or their professional reputation. This period was indeed very significant for them.

For students, most of whom spend only four years in the Faculty and

graduate before the age of 25, a quarter century is next to an eternity. Nevertheless, the few years they do spend here are normally filled with joy and excitement, with making choices and decisions, friendships and relationships and with the acquisition of knowledge and experience, all of which affect their entire post-university life. Some of the fondest memories of graduands, savored long after leaving the halls of learning, are from those *carefree college days*, which clearly represent a most significant period in their life.

Writing the history of the Faculty at this juncture was timely and wise for a number of reasons. Firstly, a few of the founding academic and support staff members of the Faculty and the departments were still present or could be contacted. Their input and help was invaluable on a number of occasions. Secondly, data sources including files, minutes of meetings, annual reports and photographs were traced or discovered with the help and recollection of some of the *old-timers*. Their help was crucial in identifying persons, staff or students, on the numerous historical photographs used throughout the volume. It was high time for this work also before more of the source material becomes misplaced, lost and no longer attainable. Unfortunately, a number of data sources or segments thereof could not be located in some of the units or in the institution. It became clear during the project that a more systematic procedure, based on a policy emphasizing the importance of preservation of our heritage, is required if we are to have complete records of the institution's history.

As stated above, this book deals with the history of the Faculty of Engineering at Calgary. It offers six specific trips into its past, visiting highlights and getting to know some of its key players. Thus, in some sense it deals with *time travel*, a subject which

together with *space travel*, has fascinated segments of mankind since the dawn of civilization. Time and space travel continue to be popular topics for science fiction writers even though the latter has become reality during the second half of the twentieth century, at least on a *limited scale*. Just how limited this activity at the turn of the millennium really is, becomes apparent when compared with the *grand tour* kind of space travel every person is experiencing while living on this magnificent spaceship called earth. To start with, the earth's rotation about its own axis imparts an eastward tangential velocity to its inhabitants which at the latitude of Calgary is over 1,050 km/hr. And this is the least spectacular aspect of this *grandiose trip*. The earth also travels along its elliptical trajectory around the sun at an average speed of 30 km/sec., completing one circuit each year. Then the entire solar system, the sun with all its planets, is circling the centre of the Milky Way galaxy at the fantastic velocity of 225 km/sec. requiring some 250 million years for one such galactic revolution of which only 20 have been completed since the time of its birth as a star. Finally, the galaxy itself is speeding along a path towards the *great attractor* in the southern constellation Centaurus at an estimated incredible velocity of 400–1,000 km/sec., a motion assumed to be the aftermath of the act of creation—the *big bang*. What complexity of motions! Just thinking about it brings forth the realization that mankind's greatest treasure is this very special globe, called *terra*, which is finally being appreciated and is beginning to receive the care it deserves.

Time travel, on the other hand, remains fiction, at least the kind one encounters in science fiction books and television programmes. And yet there is an uncanny reality to move-

ment through this elusive medium called time, which every living entity experiences. Throughout life, during which one carves out and moves along a unique world-line through the space-time continuum, time appears to flow like a river, relentlessly and 'irreversibly', slowly at first and accelerating as the years accumulate. At the while the future is moving up to become the present and the *moments of now* quickly fade into the past. The present appears to be but a *boundary* between these two main time domains, constantly moving forward into the future and leaving behind and accumulating the past. Like the surfer riding the crest of a wave, so do living entities and life itself appear to move with this *boundary*. Thus, like space travel, time travel is in some sense also an everyday experience.

However, this experience as well as visits to the past, such as those described in this book, are not the only forms of time travel possible at present. There's another, unique and more realistic form of motion through space-time, the understanding and appreciation of which will be facilitated by the following brief reflection.

'Twinkle, twinkle little star,
How I wonder what you are,'²

Almost instantly these words awaken childhood memories for many. They likely also help to bring into focus the grandeur of a clear summer night sky with its millions of stars appearing as tiny holes in the dark blue firmament through which the lights of heaven shine. While being overwhelmed by the majesty of such a view, one tends to forget that the lights being observed represent a gigantic record of the entire history of the universe allowing glimpses into its past, back to near the beginning of time—the *big bang*.

The light, coming from billions of stars and galaxies, has been under way for years, millennia or thousands of millennia, depending on their distance from the earth at the time it was emitted. What is observed now was reality many years or eons ago. A particular star from which light is being received may not even exist any more and if it does, it is surely located in a position different from that indicated by the incoming light. Clearly, the starry sky is much more than one of nature's most beautiful displays. It is for astronomers, physicists and cosmologists a fascinating research laboratory which enables them to observe and investigate the past and move around in it, almost as if they were there. The vastness of space and time are coupled and another form of time travel into the past becomes, in some sense, a reality.

For most of us, a *trip down memory lane* or a tour into a specific period of the past through historical descriptions like those presented in this anniversary volume, remain the only possible *exotic* forms of time travel in the foreseeable future, these, of course, in addition to the above noted *everyday-experience* kind of time travel which has a number of unusual and/or undesirable characteristics: it is imposed to be unidirectional, of constant rate without intermittent stops, of limited duration and is often, if not always, terminated prior to expected or planned conclusion of travel.

¹ Starting in ancient times and down through the ages, philosophers and writers have compared the passage of time to the flow of a river as did, for example, the Roman poet Ovid (43 B.C. – A.D. 18) in his work entitled *Metamorphoses*, xlv, 180. Much has also been written about the *arrow of time* even though the fundamental nature of time, its reality and existence continue to be the subject of research and lively discussions and arguments among scientists and philosophers.

² From the childhood rhyme, *The Star* by Jane Taylor.

ACKNOWLEDGEMENTS

As the Engineering representative on the President's 25th Anniversary Celebration Planning Committee, Dr. A.E. McMullen gave a brief report to Engineering Faculty Council on March 20, 1990. He outlined preliminary suggestions of anniversary celebration activities and events for the period April 1 - Dec 31, 1991. After a discussion of the report, Council decided to establish a *Faculty of Engineering 25th Anniversary Celebration Committee*, FEAC, with Art McMullen as Chair and a representative from each department, to be named by the Striking Committee. The Committee membership was subsequently established as follows: Drs. H.A.R. dePaiva, CE, K.V. S. Kaler, EE, E.J. Krakowsky, SJ, X. Mao, ME and E.L. Tolofson, ChE, with Dean E. Rhodes serving as Ex Officio member and becoming a staunch supporter of the Committee's activities.

At its first meeting, the Committee decided on six projects "worthy of further investigation" and assigned one to each of its members. The Faculty's history was one of these proposals for which Rod dePaiva was asked to develop an outline plan. At the next meeting on June 22, he reported on having obtained a copy of a "history" which he and the group felt "would be a good starting point". It was unanimously agreed that the history project should be pursued. Consequently Art McMullen informed Council on Sept. 18, that "a History of the Faculty of Engineering will be prepared".

By early October¹, the writer had agreed to take on responsibility for the Faculty history publication after he had been invited by Rod dePaiva, on behalf of FEAC, and had been assured of the appointment of a *resource person* from each department. The Committee gave final approval to the project on Nov. 2, 1990.

even though no resources were on hand to cover the estimated cost of \$5,000 for the production of 2,000 copies of a 50 page soft-cover *coffee-table-style booklet* containing some 50 color photographs. The writer was informed² of this decision and was asked "to get the project underway". Also, the Chairman informed each Head in Engineering that the writer had agreed to take this project "in hand"³ and would contact him concerning the selection of an individual from his unit.

At its meeting on Nov. 30th, where Rod dePaiva presented a revised cost estimate of \$12,000 for the proposed publication, the Committee decided to apply for financial assistance to the Board's Special Projects Fund, an application which resulted in a \$3,000 grant in the Spring of 1991. At the same meeting Art McMullen informed the group that "a departmental resource person" had been named by Electrical and Mechanical Engineering, Profs. G.J. Berg and A.A. Torvi, respectively. These two academics, together with Drs. Rod dePaiva, Ed Krakowsky and Matt Mohtadi, named by Civil, Surveying and Chemical Engineering, respectively, would form what was referred to as the *Faculty History Committee*, FHC, chaired by the writer. This group met for the first time on Dec. 19, 1990.

The Faculty History Committee met six times between Dec. 19, 1990 and August 19, 1991 and provided valuable advice and guidance. At its early meetings it served as a *think tank* generating ideas and guidelines which were particularly useful and significant during that early, evolutionary phase of the project. FHC proposed key features for the book, such as the listing of all engineering graduates, major scholarship and award winners and academic and support

staff. In addition, each member of FHC provided written and/or verbal input, collected or helped to find relevant data sources and photographs and assisted in locating persons who could provide information or identify students and staff depicted on pictures. Each member also read the final draft of the chapter treating the history of his department, commenting on the work and making suggestions for changes and/or corrections. For all this help the writer is deeply grateful.

Special thanks are due to Prof. A.A. Torvi who was ready to help throughout and on any aspect of the project and was willing to be responsible for obtaining material relevant not only to his department but also for an originally proposed chapter on student activities. Recognition and special thanks are due also to two further members of FHC. Dr. R.E. Loov became a member of the Committee effective Feb. 1991 after Rod dePaiva had asked to be relieved of his duties as Civil Engineering's resource person. Bob Loov was particularly successful in obtaining an unusually large collection of rare old photographs many of which are real *historical treasures* and were used to enrich this volume. Mrs. Kathleen Rempel, Faculty Communications Manager during 1991, joined the Committee in May. She took on the task of preparing a first draft of the List of Graduates and proof-read Chapters I, II and parts of VI, making numerous suggestions for improvements.

One of the first persons visited by the writer concerning the History was Dr. G.W. Govier, Dean of Engineering, 1959-63. He agreed to meet on March 12, 1991. During our conversation, which is recorded, many interesting details of the early history of Engineering at Calgary were reviewed.

¹ Minutes of FEAC's meeting, May 22, 1990.

² Glockner, P.G. *Development of Engineering and Mechanical Engineering at The U of C*, Dept. Mech. Eng. Report # 200, April 1981, pp. 1-24. Pre-1977 departmental enrollments given in that report and obtained in 1981 from the Faculty's Student Affairs files are used throughout this volume. O.A. records show only total Faculty enrollments for 3rd and 4th year prior to 1977, not separating those numbers into departmental figures.

³ McMullen, A.E. *U of C 25th Anniversary Celebrations - Progress Report to EFC*, dated Sept. 10, 1990, pp. 1-2.

⁴ dePaiva, H.A.R. *History of the Faculty of Engineering*, a document suggesting content, format and guidelines for the proposed publication, Oct. 11, 1990, pp. 1-2.

⁵ Memo from Dr. H.A.R. dePaiva to the writer, Nov. 5, 1990.

⁶ Memo from Dr. A.E. McMullen to the Heads in Engineering, Nov. 7, 1990.

for which the writer is thankful

The pictorial record of the Faculty's history would be meager, indeed, without Mr Bert Jinterberger's photographs, as is confirmed by the numerous plates bearing the B U designation. Although not indicated most of the portraits used in the book also came from Bert's files or from what he called his 'drawers of junk'. His contribution to this project was most significant and is gratefully acknowledged. A substantial number of portraits, particularly of academics from the early years, were obtained from the Director of Academic Administration, Miss Elsie Lundquist, whose friendly and prompt assistance throughout the project is recognized with sincere appreciation.

A main source of information and photographs was the University Archives the resources of which were utilized more conveniently and effectively with the kind assistance of the University Archivist Jean F Tener. Staff Archivist Jo-Ann Munn Gafuk and all the staff. Sincerest thanks for their continuous help. Many of the photographs were obtained from the Photographic Section of the Department of Communications Media where Ms. Marjorie D Bowman and Mr David H. Brown provided prompt assistance with a smile for which heartfelt thanks are expressed.

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Written input was received, upon request, from Drs. T H Barton, L T Bruton, H A R dePaiva, A G Doige, O P Malik, A E McMullen, Mr V P Panilio and Drs. R A Stern, J E S Venart, M A Ward and S C Wrasinghe. Mike Ward also provided

unique photographs and significant information. For example, he deciphered the writing on Plate 2 52a and he helped to identify persons on Plates 2 52b, c. The writer also relied heavily on his assistance in reconstructing the sequence of events leading up to the introduction of the surveying engineering programme and the project management specialization. For the help obtained from him and colleagues listed in this paragraph, the writer is truly thankful.

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Listing names in the case of such a large number of contributors invariably leads to certain individuals being inadvertently left out. The writer's apologies to those whose names were missed and his sincere appreciation for their help and contribution.

The writer is, of course, solely responsible for the contents of the book and any remaining errors.

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APPENDIX A

BACKGROUND INFORMATION AND EVENTS RELATED TO INITIATION OF ENGINEERING IN CALGARY

After the conclusion of World War I the Calgary Normal School, which was responsible for training primary and secondary school teachers and which had been established in Calgary in 1905 by the province, returned to the S.A.T. Campus and became the Southern Extension of the University of Alberta's Faculty of Education. The following year in 1946, citizens of Calgary formed the Calgary University Committee (CUC) to exert political pressure on the government for the establishment of university facilities in their city. In 1947 Dr. A.L. (Andy) Doucette was appointed first Director of the Calgary Branch of the University of Alberta and the first two years of the BEd programme were initiated. At the same time the City of Calgary set aside land in Hounsfield Heights, southwest of the S.A.T. Campus, for an eventual University site. This land was exchanged for a stretch of prairie along the Old Banff Highway in 1950.

On May 2, 1951, the CUC sponsored a public meeting to urge expansion of the Calgary operation of the University of Alberta including programme offerings in Arts and Science, Engineering and Commerce. The Board established a Committee which studied the Calgary situation. In June 1951, in considering the Committee's report the Board was not prepared to recommend the extension of instruction and facilities so as to be able to provide first year Engineering in Calgary. The University authorities in Calgary and the CUC were so informed. Interestingly, however, first year Arts and Science programmes were initiated in the Fall of 1951 at Calgary.

In the Spring of 1952 the CUC conducted a survey of Grade 12 students matriculating from Calgary high schools which their Executive discussed at its meeting on Friday, July 18. The survey showed that 125 matriculants intend to enroll in first year courses at the Calgary Branch of the University, 50 of whom were interested in taking Engineering. In view of these statistics another letter was sent to the President, dated July 22, 1952, in which the Committee respectfully requests that further consideration be given to the provision of first year Engineering at the Calgary Branch. A response dated July 23, 1952 from Dr. Walter H. Johns, Assistant to the President, informed the Committee as follows: "So far as offering courses in Engineering is concerned, regret to say that the Board of Governors at their recent meeting decided that no provision

should be made for any expansion of courses at Calgary until some improvement has been shown in the registration in existing courses. This decision was taken with the addition of courses in Engineering in mind."

The CUC, however, did not let up. On January 16, 1953, they organized a Public Meeting with 1200 people in attendance who unanimously passed the resolution that a recommendation be made to the University of Alberta for additional first year courses to be offered in Engineering, Commerce and Home Economics. Mr. Harry F. Francis, Chairman of the CUC, transmitted the resolution and the summary of the discussions from that Meeting to President Stewart in a three page letter dated January 23, 1953. In his response of February 12, 1953, the President informed Mr. Francis that his letter had been read at the meeting of the Board of Governors on February 6. He also informed him that the Board had instructed the President to explore methods of offering the first year of the Commerce program in Calgary next year. With regard to Engineering the President wrote: "In the case of Engineering additional course and facilities would be required. No provision has been made in the 1953-54 estimates for the necessary expenditures. When the Board of Governors considered the report of its Committee which studied the Calgary situation in June 1951, the Board was not prepared to recommend the extension of instruction and facilities to provide for first year Engineering. The Board does not feel that any subsequent developments would justify a change in its position."

Less than a year passed before the question of offering first year Engineering was again before the Board of Governors. At its meeting on June 4, 1954, President Andrew Stewart reported that he had a visit from the Chairman of the Executive Committee of the CUC, Mrs. H.T. Robertson, and that in addition he had also received a letter from the Secretary of that Committee, Mr. Geier, forwarding the following resolution:

That the University authorities be requested to offer at the Calgary Branch of the University of Alberta, the following:

- the full Arts and Science course leading to a degree, to be instituted progressively, the second year to be offered in the 1954-55 session, and the third year in the 1955-56 session;
- the complete course leading to the Bachelor of Education degree.

c) the first year in Engineering.

In his reply to Mr. Geier, the President pointed out that no provision for expansion of the Calgary operation had been made in the current 1954-55 estimates and furthermore that any attempt to offer the many courses involved would require additional staff and facilities out of proportion to the potential student numbers. The Board took no further action at that time.

At a meeting of the Executive Committee of the Board on February 4, 1955, in connection with a discussion of a report prepared by the Committee on Affiliations, the President expressed the view that in 6 or 7 years, if the University continues to grow at the present rate of 350 students per year, the University at Edmonton will have 6000 students which is the most that should be accommodated in one institution. Though should be given to junior work being taken in other Alberta communities.

On March 18, 1955, the Board amended and approved a statement by the President covering the Board's thinking with regard to the expansion of University facilities in Calgary based on the report of the Committee on Affiliations. This statement was presented to the CUC and the Education Committee of the Calgary Chamber of Commerce. The President's report as well as the discussions concerning it were "in camera" and were not made available to the press.

The CUC wanted to make the President's report public but their request was deferred by the Executive of the Board of Governors.

At the next full meeting of the Board, on June 3, 1955, a delegation from the CUC, consisting of Mrs. H.T. Robertson, Chairman, Mr. P.P.C. Haigh and Alderman Grant McEwan, was in attendance. The delegation addressed the Board for 45 minutes regarding decentralization of University facilities with respect to Calgary. Mrs. Robertson presented a submission from the CUC, in which the Committee recommended "The immediate systematic and progressive expansion of University facilities in Calgary." Five major reasons were set forth for this recommendation on the basis of which:

"The Calgary University Committee requests that plans be made for the systematic development of University facilities in Calgary such facilities to include:

- the full Arts and Science course leading to a degree, to be instituted progressively;

- b) the complete course leading to the Bachelor of Education degree.
- c) the first year in Engineering;
- d) Additional training programmes which may be accepted from time to time as part of the University's responsibility

In keeping with the enhanced status of University facilities recommended above, the Committee requests also that the designation of the university facilities in Calgary be changed from Calgary Branch to 'The University of Alberta, Calgary'.

After the presentation, discussion turned to the property held by the CUC on a 20-year lease and its suitability as a University site. The President informed those present that he had received a letter from the Calgary City Planner's Office informing him that a report on the property was forthcoming. However, no further word had been received from Calgary. The land is owned by the City of Calgary and the question of price had not been discussed.

The President also commented that no expansion of courses is possible within the present facilities at the S.A.T. Campus to which Mrs. Robertson responded by re-emphasizing the immediate need for a definitive plan for expansion of university facilities in Calgary. The President expressed the opinion that adding first year of Engineering to the programme offerings in Calgary would provide first year instruction in all major areas. He also suggested that it might be possible to work out satisfactory arrangements for the offering of some second year programmes.

After the Committee had retired the Board passed a motion instructing the President to recommend to the Minister of Education joint discussions between the University and the Department of Education regarding post high school education. It was also suggested that the Chairman of the Board, the Chancellor and the President visit the Minister of Education. The President was to advise the CUC that the submission was being actively studied.

As a result of this and a Calgary University site-related-activity appears to have resulted in the matter of first year Engineering in Calgary surfacing in Engineering Faculty Council. The EFC Minutes of Monday, March 19, 1956, contain the following statement under Item no. 605 Other Business:

'Dean Hardy informed the Faculty that the first year of Engineering in Calgary is very much of a current issue. He stated that Dr. Johns had raised the question with him whether we would be prepared to offer it next fall. A site has been reserved by the City for the University in Calgary. The Dean drew to the Faculty members' attention that there would have to be engineering staff to handle Drawing, E.M. 1, C.E. 10, C.E. 5 and C.E. 6, and suggested that there would be considerable difficulty with C.E. 6 due to the expense of providing surveying equipment and the lack of sufficient staff to handle this course. It was

suggested by Professor Porteous that we have a survey camp and Professor Gads suggested that a committee be appointed to study the matter but Dean Hardy felt that it would not be feasible to try to put it in this next fall and that a committee would not be necessary right now. He stated that he would inform Dr. Johns of the Faculty discussion.

At the October 5, 1956 meeting of the Board of Governors, the President reported that owners of a small 20 acre parcel, within the 348 acre University site were holding out for a price which the City of Calgary was reluctant to pay. The President was asked to look over the site to see if without these 20 acres it would still be satisfactory.

At the Executive Committee meeting of the Board on October 23, 1956, the President reported that he and Dean Hardy had visited the proposed University site while in Calgary on Wednesday, October 10. Both of them felt that the 20 acre parcel at the center of the southern edge of the property would be essential for the integrity of the Campus and should be acquired by the City of Calgary.

In the meantime Engineering Faculty Council met on Tuesday, October 16 at which time Dean Hardy reported briefly of his visit with the President to Calgary. Agenda Item no. 8 of that EFC meeting reads as follows:

'Dean Hardy informed the Faculty that the President had asked him to go to Calgary with him last week to discuss with members of the Calgary Branch of the University the possibility of having first year engineering at the Calgary Branch next session. He stated that it seems to be a simple thing to offer it there next fall and a recommendation is going to the Board of Governors that the first year of Engineering be offered at the Calgary Branch commencing in September 1957 and with the number of students restricted to 60 students. The staff requirements for first year involve Physics, Chemistry, Mathematics and Civil Engineering. The Physics, Chemistry and Mathematics requirements have been discussed with the Dean of Arts & Science and Calgary has the staff requirements provided for in their budget. As far as Civil courses are concerned we will need two men and will have to provide for them in our budget. They have sufficient lecture rooms and a room which was set up for Geologists to be equipped for joint use with Drawing. As far as survey school is concerned, the most feasible thing to do would be to send one or two junior men to Calgary when we are doing survey school in Edmonton. New equipment will have to be bought if we hold a survey school in Calgary. Dean Hardy asked Faculty if there were any grave objections to the proposal to have first year Engineering in Calgary. Dr. Scott stated that he was opposed. This plan would require one man for Physics and he suggested that it would be even more difficult to get a man just to teach first year students than it is to get men here. He suggested that there could be a collapse in educational standards. Dr. Grayson-Smith agreed with Dr. Scott. Dean Hardy stated that they would need only 1/2 a man's time in Physics and 1/2 in Mathematics; Chemistry would require no additional assistance, but we would have to arrange staff for Civil courses. He then stated

that as far as the policy of going into Calgary is concerned the University is now definitely committed to facilities in Calgary. He also stated the thing which surprised him was that there are so few technical difficulties in putting Engineering in at Calgary and feels that it could possibly relieve first year here.

From Dean Hardy's report and the discussion which followed it would appear that a decision had been made to start first year Engineering at Calgary in the Fall of 1957 and that it was Dean Hardy's understanding that a recommendation to this effect would go to the Board of Governors in the near future. There was no mention of initiating first year Engineering in Calgary in the Minutes of the Executive Committee meeting on October 23, 1956 nor could I find any such motion or discussion in the meeting of the Board of Governors held on November 23, 1956. However, in reviewing the estimates for fiscal 1957-58 at this latter meeting, a Summary Statement of the estimates was distributed and commented on by President Andrew Stewart as follows: 'Increases in staff are needed to institute first year Engineering at Calgary, to handle the expected increased enrollment, mainly in Arts and Science, . . .'. This summary statement was approved by the Board. Thus it appears that the decision to offer first year Engineering in Calgary had been made by President Andrew Stewart in consultation with Dean R. M. Hardy and with the approval of Government officials, likely the Minister of Education and perhaps even the Premier and his Cabinet.

At the Board of Governors' meeting of June 21, 1957, H. R. McArthur's promotion from Assistant to Associate Professor of Applied Mechanics effective September 1, 1957 and removal expenses to Calgary were approved. In discussing this item the President noted that 'The offering of first year Engineering in Calgary would also mean some expenditure on equipment'. At the Executive Committee meeting of August 12, 1957, the appointment of W. H. St. well as Assistant Professor of Civil Engineering in Calgary for a two year probationary period effective September 1, 1957 was approved. It appears that although Professor St. well had been hired by Dean Hardy in the Spring of 1957 approval for that action was not sought until just six or seven weeks before classes were to start in the first year Engineering programme in Calgary.

At the October 15, 1959 meeting of Engineering Faculty Council, Dean Govier and Associate Professor Panar reported that progress on the Calgary buildings was slow and that there now appeared only a slim chance that facilities would be ready to permit the start of Second Year Engineering in the Fall of 1960.

APPENDIX B

HIGHLIGHTS OF ENGINEERING STUDENT ACTIVITIES AT SAIT AND OUTSTANDING ACHIEVEMENTS AND ACCOMPLISHMENTS OF MEMBERS OF THE FIRST CALGARY ENGINEERING CLASS

The inaugural First Year Engineering class in the Spring of 1958 consisted of the following 55 members

| | |
|--|---|
| Branson, James, Markerville, BSc '61 (EE)* | Kostiw, Paul, Calgary |
| Brown, Charles, Calgary | Koubsky, Peter, Calgary |
| Bullen, Ron, Calgary, BSc '61 (ME) | Lee, Edward, Calgary |
| Burn, Ian, Calgary | McAdam, Don, Calgary, BSc '61 (ME) |
| Cahoon, John, Calgary, BSc '61 (MetE), PhD '64 (ME) | McRobb, Donald, Calgary |
| Charbonneau, Arthur, Calgary, BSc '61 (CE) | Messina, Fred, Calgary |
| Cliff, Harold, Calgary | Mew, Tim Sack, Bowness, BSc '65 (EE) |
| DeSmon, Anthony, Calgary, BSc '61 (CE) | Mikossy, Eugene, Calgary |
| Douglas, Peter, Calgary, BSc '61 (CE) | Mossman, James, Calgary, BSc '63 (CE) |
| Driedger, Klaus, Calgary, BSc '61 (CE) | Neigel, Neill, Calgary |
| Enns, Eric, Rosemary | Northfield, Dexter, Calgary, BSc '62 (CE) |
| Farries, Leonard, Black Diamond, BSc '63 (ME) | O'Connor, John, Calgary |
| Fulton, Robert, Rockyford | Portfors, Ernest, Hanna, BSc '61 (CE), MSc '63 (CE)
(Aberdeen), PhD '69 (ME) (Toronto) |
| Gaudek, Frank, Calgary | Pottenger, Gerald, Calgary |
| Goodrich, Norman, Calgary, BSc '61 (CE), MSc '68 (CE)
(Calgary) | Ross, James, Saskatoon, Sask., BSc '61 (CE) |
| Guarnasche, Claudio, Calgary, BSc '61 (ME) | Shoults, Walter, Calgary |
| Hayman, Allan, Calgary | Simpson, Michael, Calgary, BSc '61 (CE) |
| Holman, James, Calgary | Smith, David, Calgary, BSc '61 (EE) |
| Hulbert, Gordon, Calgary | Sparling, Joseph, Calgary, BSc '61 (ChE) |
| Jacobsen, Norman, Arrowwood | Stagg, Keith, Calgary, BSc '62 (ME) |
| Janz, Henry, Calgary | Strecker, Samuel, Lethbridge |
| Jensen, Brian, Bassano | Sturm, Walter, Calgary, BSc '61 (EPhy) |
| Johnson, Roger, Calgary, BSc '63 (CE) | Tester, Gordon, Redcliff |
| Jones, Glen, Calgary, BSc '61 (EE) | Tomlinson, Terry, Calgary |
| Kathol, Ronald, Rockyford, BSc '61 (CE) | Webster, Warren, Calgary, BSc '61 (EE) |
| Kaul, Udo, Calgary, BSc '61 (ME) | Williams, Ross, Calgary, BSc '62 (CE) |
| King, Richard, Calgary | Wilson, Goodricke, Calgary |
| Kitagawa, Shigeru, Rosemary, BSc '61 (ME) | |

As stated earlier they were a very active and unusually talented group of young men. From the day of their arrival on campus they were involved in and influenced every aspect of student life at the campus of the Institute of Technology and Art. They participated in the various Frosh Week activities including snake dancing, wiener roasting and in the usual annual *Frosh Week Finale*, the trip to Banff where 'some got lost in the mountains, some fell into the river and some sang their voices out but all had fun!' They participated in the Wayne Society's Hayride, provided hilarious entertainment at the First Engineering General Assembly

organized an off-campus dance at the then fashionable restaurant the *Iste of Capri*, on November 23, 1957 which turned out to be an instant success and was designated to be an annual event. In their first try they had a 100% turnout at the Red Cross Blood Donor Clinic, winning the *Bloody Cup*, a tradition which the Engineering students upheld over the years. To achieve the 100% turnout some members of the class had to be *persuaded* since they had never given blood. So unusual was this experience for Bill Webster that after he saw the blood appear from his pricked finger he fainted and fell flat on the floor. Norm Goodrich, who was standing behind him and

was observing the drop of blood on his own finger, just caught himself in time to sit down on the floor before passing out.

After establishing the Engineering Student Society (ESS) they elected their first executive including Eugene Mikossy, President, Richard King, Vice President and Fred Messina, Secretary/Treasurer. Two of the members were representatives on the Student Council, Udo Kaul and Roger Johnson, the former of whom was chosen to serve on the University Athletics Board as President of Men's Athletics. There were 4 engineers on the mens' basketball team, Peter Douglas, Richard King,

Bullen, Ronald. 'Class History', Evergreen and Gold 1958, pp. 57-58.

* Degree obtained from U. of A. unless otherwise stated

Ed Lee and Mike Simpson. Dexter 'Burn-Burn' Northred was one of the prolific scorers of the hockey team and Keith 'the server' Stagg was one of the volleyball team stars. In the Winter Week inter faculty broomball event they beat Arts and Science (7-0) and Education (3-0) to emerge as champions. They helped to found the Portica Science Club in January 1958 and were active in the weekly half-hour radio program *Varsity Vista*, a red on CFAC Wednesday evenings at 7:30 p.m. They elected Peggy Graham, an Education J.E. student from Calgary, as their *Queen*, who in a field of seven candidates, became *second-lady-in-waiting* to campus queen Gail Lewis, the Arts and Science queen crowned at the Test Tube Trot Dance. During Queen Week they added a bit of extra excitement by kidnapping the *first-lady-in-waiting* Bev Sherwood, who was entertained royally by the engineers.

Approximately 40% of the class went on to study Engineering at the University of Alberta. Specifically 21 of them graduated in the Spring of 1961 in the Faculty of Engineering as indicated by the degree designations next to their names in the class list above. Several more obtained degrees in other faculties at the University of Alberta or at other universities as well as in subsequent years. Many of them were extremely talented, as indicated by the awards and prizes they won at the end of their undergraduate studies. For example Ernest A. Portfors from Hanna, Alberta won the 1961 Athlone Fellowship and the APEGGA Gold Medal in Civil Engineering. After a year at Imperial College, an MSc and PhD (from Aberdeen '63 and Toronto '69) he went on to work for B.C. Hydro and a consulting firm in which his former Calgary classmate, Art Charbonneau, was a principal. In 1976 he joined Kiohn-Leonoff Ltd. in Vancouver where he stayed and where he has become a partner and in 1991 was Vice-President of engineering, responsible for some 225 employees in four offices, including Calgary, Seattle and Whitehorse. He has been very active in the professional association of B.C. and served as President in 1985-86. Jack R. Cahoon from Calgary won the Steel Company of

Canada Fellowship in Metallurgy, stayed at the University of Alberta to obtain a PhD in Mechanical Engineering and ultimately became Professor and Head of the Department of Mechanical Engineering at the University of Manitoba. The class historian, Ronald S. Bullen, worked after graduation for 15 years and then established his own company, Canadian Fracmaster, an oil and gas industry service company of which he is President and part owner with North American headquarters in Calgary, worldwide operations handled out of their Cypress Office and with activity around the globe, including Alaska and a 500 man contingent in Siberia in 1991. Michael E. Simpson, President of ESS during his final year of study in Edmonton, together with classmate Norman K. Goodrich and the 1990 Distinguished Alumni Award recipient, Barry Lester, formed and are operating in 1991 a very successful consulting firm in Calgary which was responsible for the design of the University's Olympic Speedskating Oval. These are but a few of the many success stories related to members of the first Calgary Engineering class.

The student activities during the 1958-59 academic year continued to be as varied and exciting as the previous year's. The ESS Executive including Val Lunsk, President; Richard Newson, Vice President; David Thurston, Treasurer; Patrick Colette, Secretary and Bill McCaig, Student Council Representative saw to it that events in which they were involved in or responsible for were successful or were won by engineers. For example, the engineers won the cross-country team trophy. Their repeat 100% turnout at the annual Red Cross Blood Donor Clinic was only good enough for a tie with the industrial Arts students who also gave it their all. Three engineering students, including Bill McCaig, were active in the Radio Society and involved in the weekly half-hour programmes on CFAC. Five members of the basketball team and five members of the hockey team were Engineering students during that year. At the beginning of the session they welcomed the executive of the ESS from Edmonton. They, once

again, organized a very successful Engineering General Assembly, sponsored a lot of the activities of Winter Week, were active in Frosh Week and elected as the second Calgary Engineering Queen, Carol Meyer, an Education J.E. student from Taber, who became first runner-up to the campus queen.

Of the 70 students successfully completing their programme 26 graduated in various departments in the Faculty of Engineering at U of A in the Spring of 1962, including 3 in Chemical Engineering, 5 in Civil Engineering, 11 in Electrical Engineering, 4 in Mechanical Engineering and 3 in Engineering Physics.

There were 69 students in Engineering in the Fall of 1959 including Margaret Jean Coatsworth, the first female student in Engineering at Calgary, who was elected Secretary Treasurer of ESS, along with Dale Harvey as President, Wayne Ballard, Vice-President and Al J. Strud, Student Council Representative. An engineer, Dennis Anderson, was elected Vice-President of the Radio Society. Their choice for Engineering Queen, Joyce Kunelius, BEd J from Calgary, won the overall race and was crowned *Campus Queen* at the Social highlight of the year, the Blue Mist Ball, held in the Social Room of the Jubilee Auditorium on November 21, 1959. Of the 59 students completing their programme in April 1960, 44 continued their studies as members of the first 2nd year engineering class at Calgary, comprising 51 students, of whom 21 graduated in the Spring of 1963 at the University of Alberta, 6 in Chemical Engineering, 4 in Civil Engineering, 9 in Electrical Engineering and 1 in Engineering Physics.

APPENDIX C – THE BLUEPRINT

George Wheeler Govier, a native Albertan born in Nanton, joined the staff of the University of Alberta in October 1940 and became Head of the Department of Chemical Engineering in 1948. Soon after he became Dean of the Faculty of Engineering, on July 1, 1959, he initiated a study which culminated in the report entitled *A Long-Term Development Plan, 1961-1980, for the Faculty on the Edmonton and Calgary Campuses* which he submitted on February 15, 1961. The report was prepared by Dr. Govier with the generous assistance of the five Engineering Department Heads: Professors G. Ford, J. A. Harle, E. O. Lilge, D. G. Robinson and S. R. Sinclair and many other individuals. The document which has become known as the *Govier Report*, uses projections for Engineering undergraduate and graduate enrollments, up to 1980, to forecast requirements for staff and physical facilities. The projections up to 1970 were based on then current registrations in elementary, junior high and high schools and were therefore 'believed to be reliable'. For the period 1970-1980 the projections were considered to be 'realistic and probably conservative'. The space requirement projections thus obtained led to the concept of the develop-

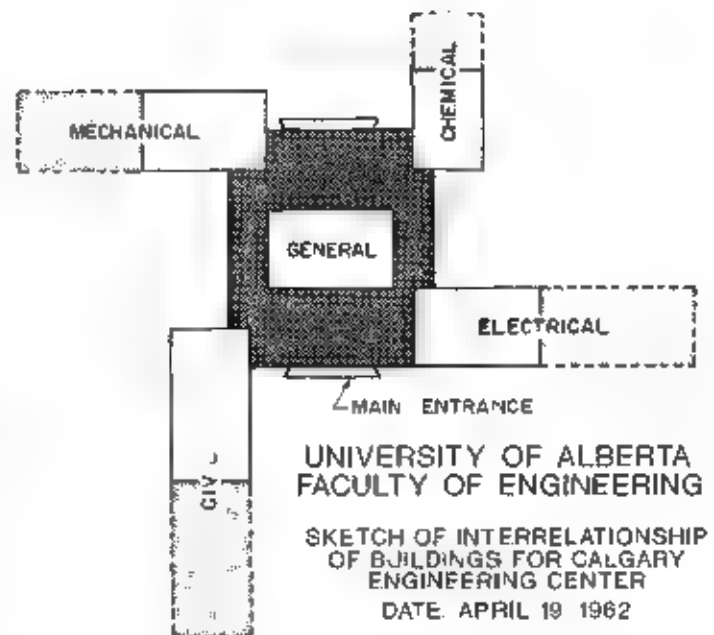
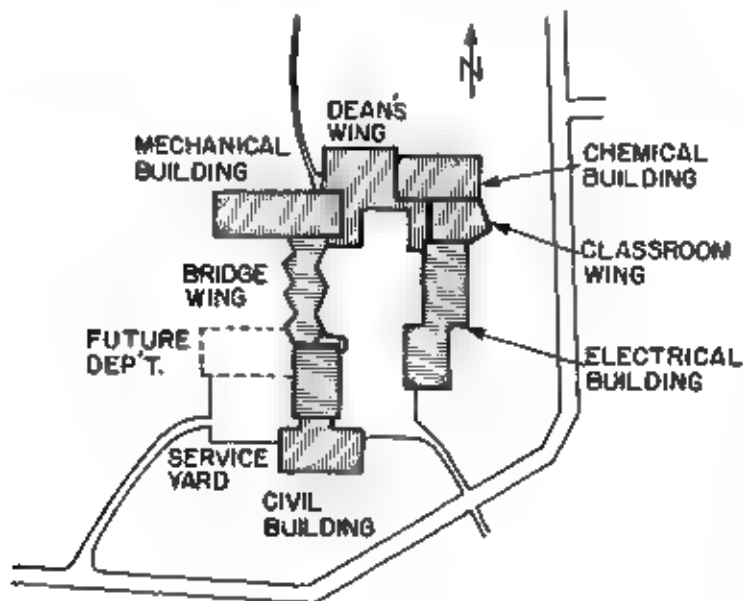


FIG. C.1



ENGINEERING CENTRE
U of A CALGARY
SITE PLAN
DATE: SEPT. 24, 1962

FIG. C.2

ment of Engineering Centres at each of the Calgary and Edmonton campuses.

For the Calgary Campus the report envisages an Engineering Centre composed of separate buildings for each of four departments, Chemical, Civil, Electrical and Mechanical Engineering, with a fifth 'general use' building in the center of the complex for classrooms, drafting laboratories, library and computational facilities and the Dean's offices. Construction was to be in stages and buildings were to be designed for vertical and horizontal expansion to accommodate future space requirements at least up to 1980. The report suggests an overall layout or configuration of the buildings by stating that the departmental 'wings' should be grouped 'around or partly around' the central general use building, 'perhaps in radial fashion'. It proposes that the first unit of the Centre, a composite use building, later to become the Civil Engineering Building, be constructed first with a gross floor area of 4 180m² (45 000 ft²) and at a total cost of \$0.9 million, to be ready for occupancy in September 1963. The document recommends that third and fourth year programmes be initiated as soon as they could be economically justified which the report equates with the achievement of a second year Engineering enrolment that

will generate a third year class size of approximately 100. With this criterion, and the enrolment projections that had been obtained, the report suggests that third and fourth year programmes be started in 1967 and 1968 respectively in the four departments mentioned and that prior to those dates the departmental buildings be completed. This time frame, in turn, defines 1969 as the year of the first Engineering graduates in Calgary who would have started first year Engineering in the Fall of 1965. The report urged that a 10-acre tract of land on the new Calgary University Campus be designated and reserved immediately for the Calgary Engineering Centre.

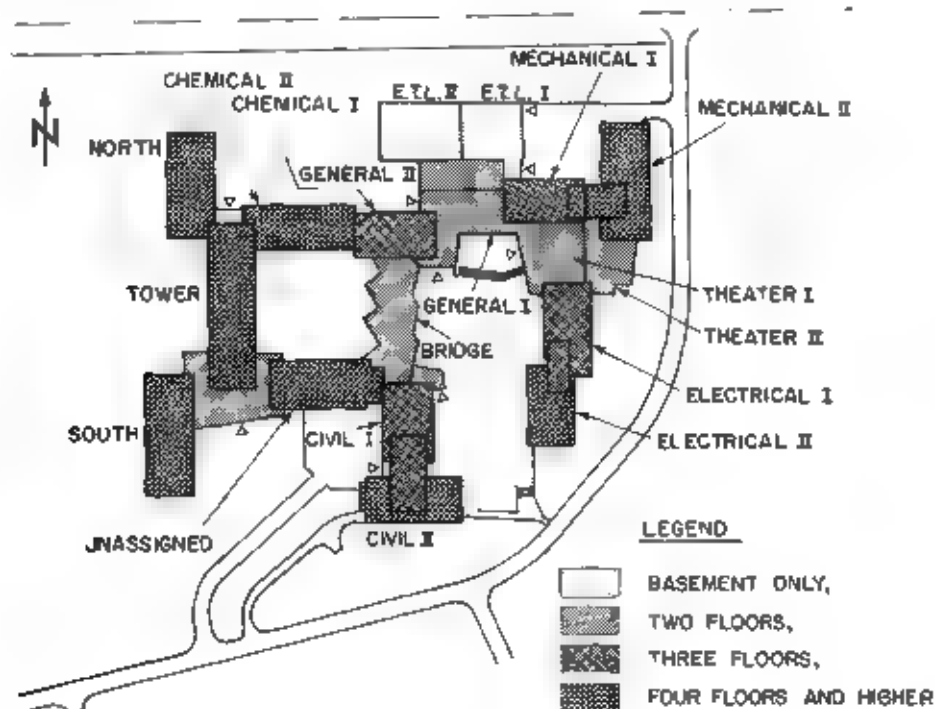
Studying this report and knowing what actually happened years after the document had been written, the accuracy with which it predicted the spatial and temporal development of the Engineering Centre and the Faculty of Engineering at Calgary is

truly amazing. It is justifiably referred to as the *blueprint* for the Engineering Faculty at The University of Calgary.

This long-term development plan was endorsed in its academic implications by the Academic Planning Committee (Minute E, 1961 10 23) and in its physical expansion implications by the Campus Planning Committee (Minute 11b 1962 09.27). The location of the first building planned for the Engineering Centre at Calgary was approved by the Board of Governors at their meeting of June 1, 1962 (Minute No. 7). The physical expansion of facilities was approved by the Board of Governors on October 5, 1962 (Minute 4a) while the overall academic implications for the entire Centre were endorsed and approved by the Board on February 1, 1963 (Minute 5).

The Faculty of Engineering Calgary Building Committee was established by Dean Govier in a memo dated

September 26, 1961 comprising Messrs McArthur, Glockner, Hebbert, de Paiva, Stilwell from Calgary and Longworth from Edmonton. This Committee was instructed to proceed with the planning of a 'general use Engineering building to be erected on the Calgary Campus, ready for occupancy in September 1963 and designed for saturation in the Fall of 1965 in accordance with the enrolment projections of the Govier Report. Implementation of the concepts contained in the Govier Report concerning grouping of departmental buildings around a general use central block led to an initial pinwheel design in the Spring of 1962 with the final L-shape of our complex emerging in September of the same year. Sketch plans for these two layouts together with an envisaged ultimate expansion of the Centre beyond 1975 or 1980, are shown in Figs C.1-C.3.



ENGINEERING CENTRE - UNIVERSITY OF CALGARY

DEVELOPMENT PLAN

DATE, JUNE 5, 1967

FIG. C.3

APPENDIX D

THE NEVILLE-GOVIER CURRICULUM PLAN

On January 7, 1964 Drs. A.M. Neville and G.W. Govier published a report entitled *The Development of the Engineering Programme University of Alberta, Calgary* in which they outlined their views on and recommendations for an undergraduate curriculum in Calgary. The essentials of this report were also published in a paper entitled *Some Ideas on Undergraduate Education at University of Alberta, Calgary* by A.M. Neville and G.W. Govier. *The Alberta Professional Engineer*, 18, No. 5, 1964, pp. 7-10.

At the second meeting of Engineering Council on Monday, November 2, 1964, the 'general aims' and 'specific features' sections of the Neville-Govier curriculum plan were adopted, almost verbatim, to form the cornerstone of the new Engineering undergraduate programme for Calgary which was implemented between 1965-1968.

Under 'General Aims' the report and the paper state the following:

University programs in engineering vary considerably in their content and depth of treatment of mathematics and the physical sciences, of the so-called basic engineering subjects, of specialized engineering subjects, and of subjects in the humanities and social sciences. The trend of recent years has been towards greater emphasis on mathematics and the physical sciences and decreased emphasis on certain specialized engineering subjects — especially those which deal with techniques or descriptive technology. These trends are proper ones but they must be viewed in the light of a set of objectives for engineering education. Bearing in mind the changing nature of society, the present tremendous influence of the works of engineering, and the role which the engineer should be playing, the broad objectives of a university undergraduate program in engineering may be stated as:

1. The provision of the foundations of a good general education, including in particular an understanding of social trends and the role of science and engineering in society.
2. The provision of the appropriate background of mathematics and the physical sciences.
3. The provision of instruction in the professional art of engineering, viz., the

methods and techniques of the application of science in the service of man.

Engineering is dependent on science but it is not synonymous with science. The engineer must have a good background of the sciences he is to apply but in addition he must know how to make the application. This means that he must have some understanding of economics, business and government and — if he is to serve humanity best — an understanding of philosophy, psychology and other social sciences. The balance of time which should be devoted to each of the three broad objectives is a matter of opinion. In Canada as a whole and in most of the United States rather little time is devoted to the first mentioned objective. This in our view is not as it should be.

It is generally recognized that full professional training cannot be given at the University and that a period of 'internship' in practice is required. None-the-less established faculties of engineering seem to find it extremely difficult to provide time for the humanities and social sciences. Among the many reasons for this are: a lack of real conviction of their importance in the engineering curriculum; ineffective use of the available time because of overlapping; reluctance to abandon some traditional engineering courses; and an attempt to provide an unwarranted degree of specialization in the program.

The University of Alberta, Calgary has a unique opportunity to develop a program with an educational balance designed to meet all these objectives. This then is the aim of the Division of Engineering.

Council next approved, in succession, all eight points of the 'Specific Features' of the Neville-Govier curriculum plan with the exception of Point no. 3 of which only the first paragraph and the first sentence of the second paragraph were recorded in the minutes of the meeting. The eight specific features appear in the minutes of Council in the following form:

1. The programme should include a co-ordinated group of courses in selected subjects in the humanities and the social sciences. Illustrative of the type of courses intended are: Philosophy, History of Industrial Civilization, Principles of Economics, Business and Government, Human Relations and Social Trends. It is believed that these courses should be taken by all engineering students and that they must be specially designed for maximum effectiveness in a full curriculum. The courses would be planned in consulta-

tion with the Faculty of Arts and Science and offered by that Faculty. A total of some 24-30 term hours for 120-140 students is involved.

2. Every effort must be made to co-ordinate course content and eliminate overlapping. This is essential to permit the offering, in a four year program, of sound modern curricula in engineering, with a proper strength in mathematics and science and with the desired content of courses in the humanities and social sciences.
3. Related to item 2 is the desirability of teaching mathematics, physics and chemistry from the point of view of sciences with engineering application. There is no doubt that an engineering undergraduate needs a strong and indeed, an increasing background of mathematics and science. But he is less concerned with the pure aspects of these subjects, with their beauty, symmetry or fundamental nature. It is the application of scientific principles and mathematical methods that is relevant to engineering development, and it is important that mathematics, physics, and chemistry, be taught from this standpoint. Experience at the University both in Calgary and Edmonton confirms the shortcomings of doing otherwise. The suggested teaching can be done either by applied mathematicians and scientists attached to the departments of the Faculty of Arts and Science or by specially qualified engineers within the Faculty of Engineering.
4. All programs should include a co-ordinated common group of courses in 'basic engineering' subjects. In the first and second years these subjects would complement the courses in the humanities and social sciences and the courses in mathematics, physics and chemistry. In the third and fourth years the common engineering courses together with common courses in the humanities, social sciences and mathematics, would constitute about one-half of the programs. The notion of a common core of basic engineering subjects recognizes the fundamental inter-relationship of all branches of engineering and the fact that only a modest amount of specialization is desirable in the undergraduate program.
5. In the third and fourth years the programs should permit a reasonable degree of specialization in each of the four major branches of engineering. This should be adequate to qualify each of the programs as one leading to a BSc in the designated branch of engineering, but should not aim at any real depth of specialization.

6. The programme should provide a sound grounding in the principles of engineering which would form a good base for graduate work, in addition to being suitable as a terminal program at the BSc level. It should be recognized that 20-25% of students will proceed to graduate work.
7. The length of the terms, now 13 clear teaching weeks, should at the earliest convenient time be increased to 15 weeks. The additional 16 weeks which would thereby be provided over the four years are highly desirable to make one term courses more effective. Furthermore, the change would provide more time for the courses in the humanities and social sciences and would make possible the desired strength in mathematics and the physical sciences, while still ensuring a reasonable minimum weight on strictly engineering subject matter.
8. The illustrative programme as amended is endorsed as indicative of the relative weights in the various fields but should not be considered firm as regards detail.

The curriculum plan shown below shows the Engineering undergraduate programme instituted in Calgary between the Fall of 1965 and 1968 with 13 one-term courses left open for departmental specializations.

At the same Council meeting it was also decided that the curriculum should be broken down into the following groups of courses with approximate weights:

Humanities — 8-9 term courses in a four year programme

Mathematics — 7-8 term courses in a four year programme

Matter — 9-10 term courses in a four year programme

Mechanics — 3-4 term courses in a four year programme

Earth Sciences — 1 term course in a four year programme

Of these the Chairman of the Engineering Council, Dr. Neville, suggested the following courses to be included in the first two years of the programme:

Mathematics — 5 term courses

Matter — 10 term courses

Mechanics — 3 term courses

Earth Sciences — 1 term course

With regard to the Faculty structure the ideas expressed in the report were summarized by Drs. Neville and Govier in the above quoted paper as follows:

Because some specialization in the main branches of engineering is considered desirable from the professional standpoint it is expedient to establish the usual departments. But they should be regarded as convenient administrative divisions, rather than watertight compartments. There is no doubt that interdepartmental cooperation is essential, especially in the areas of study which properly belong to more than one department, e.g. thermodynamics, heat transfer, mechanics of fluids, control and systems of engineering. Interdepartmental committees and common laboratories are proposed for these fields of study in order to make such cooperation more effective.

Since students in the first and second year do not really belong to any department

and because careful coordination of courses at this level is vital it is proposed to appoint a director of common studies who would have the status of a department head. He would not belong to any department and would be responsible for the coordination of a common courses including those in the third and fourth years.

These ideas were discussed and approved by Engineering Faculty Council at its sixth and seventh meetings on December 15, 1965 and January 12, 1966, respectively.

The curriculum as outlined above was designed, course by course, and implemented for first through fourth year programmes between 1965 and 1968, respectively. Already in 1968 changes were made to the first two years of the programme. There were a number of revisions, changes and modifications in subsequent years, most of them dealing with the weight of the programme in terms of content and in-class time resulting in unusually high attrition rates, especially for first and second year students. Despite its shortcomings, the Calgary Engineering undergraduate programme, which was based on this Neville Govier curriculum plan, was an innovative daring experiment in undergraduate Engineering education at the time and served the Faculty of Engineering at Calgary well for over 25 years.

TABLE D 1 - THE ENGINEERING CURRICULUM 1965-66

| TERM | TERM 2 | TERM 3 | TERM 4 | TERM 5 | TERM 6 | TERM 7 | TERM 8 |
|--|---|---|--|--|---|---------------------------------------|--|
| MATH 207
CALCULUS I
3-1T | MATH 200
CALCULUS I
3-1T | MATH 207
DIFF. EQU.
3-1T | ENGG 201
STATISTICAL METHODS
IN ENG. 2-2T | MATH 407
ADV. CALCULUS
3-2T | MATH 401
ADV. CALCULUS II
3-2T | ENGG 502
NUMERICAL METHODS
3-2T | ENGG 501
MATH. APPLICATION
IN ENG. 3-2 |
| CHEM 221
INORGANIC CHEM.
3-32 | CHEM 223
ORGANIC CHEM.
3-32 | ENGG 302
ENGL. THERM. I
3-32T | ENGG 303
ENGL. THERM. II
3-1 | ENGG 400
INTRO. FLUID MECH.
3-32 | ENGG 401
INTRO. HEAT TRANS.
2-32 | ENGG 400
SYSTEMS & CONTROL
4-32 | ★ |
| GEOLOGY 230
PHYSICAL GEOLOGY
3-0 | PHYS 232
ELECTR. AND MAGNETISM
4-1T-32 | PHYS 302
ATOMIC AND NUCLEAR
PHENOMENA 3-1T-32 | ENGG 305
BEHAVIOUR OF SOLIDS
3-1 | * | * | * | * |
| ENGG 201
BEHAVIOUR OF GASES
AND FLUIDS 2-32 | ENGG 204
COMPUTER LANGUAGE
2-2T | ENGG 303
ELECTRICAL CIRCUIT
AND MACHINES 2-32 | ENGG 304
ELECTRONIC CIRCUITS
& DEVICES 4-1T-32 | * | * | * | * |
| ENGG/PHYS 202
ENGG MECH.
2-2T | ENGG 203
ENGG. MECH. II
2-2T | ENGG 307
ENGG. MECHANICS II
2-2T | ENGG 306
MECH. OF MATERIALS
3-1T-1 | * | * | * | * |
| ENGLISH 250
ENGLISH FOR ENG.
2-0 | ENGLISH 250
ENGLISH FOR ENG.
2-0 | ECON 200
PRINCIPLES OF
ECONOMICS 2-1T | ECON 200
PRINCIPLES OF
ECONOMICS 2-1T | PSYCH 201
ELEMENTS OF
PSYCHOLOGY 3-0 | SOC 402
PRINCIPLES OF
SOCIOLOGY 3-0 | COURSE IN
POLITICAL SCIENCE
3-0 | SOC 403
SOCIAL TRENDS
3-0 |
| ENGG 205
ORIENTATION TO
ENG. PROFESSION 1-1T | ENGG 205
ORIENTATION TO
ENG. PROFESSION 1-1T | ENGG 311
ENG. APPLICATIONS
OF MATH 1-1T | | | | | |
| ENGG 206
DRAFTING
0-3 | ENGG 207
SURVEY SCHOOL 12
DAYS AT END OF 2ND TERM | ENGG 309
DRAFTING AND
GRAPHICS II 0-3 | | | | | |
| PHYSICAL ED
0-2 | PHYSICAL ED
0-2 | | | | | | |

APPENDIX E

TOWARDS PETROLEUM ENGINEERING

Introduction

Chapter II indicates a clearly definable thread of activity related to petroleum engineering which starts in 1964, grows stronger with time and is most pronounced in the areas of graduate study and research. Due to space limitations, many highlights of these activities and the associated developments or initiatives are indicated only in capsule form or are omitted altogether. The purpose of this Appendix is to bring together in a brief review, the key events, proposals and achievements in this field and to provide additional details concerning some of the milestones already passed and yet to be reached along the road to petroleum engineering.

The Initial Steps

The first steps towards petroleum engineering were taken as soon as Engineering on the Calgary campus had settled into its own new home (the E block), in September 1964, almost 2 years before the Department was born. A newly appointed Special Lecturer in Engineering, Dr. A.H. (Andy) Younger, began offering a course on *Natural Gas Processing* (Pet. Eng. 586 according to U. of A.'s graduate course numbering system) during the 1964-65 academic year. The demand for the course and its success led to its annual offering during the following 7 years, with only its course number being revised twice. In 1971, the 2 lecture/week full course was expanded and split into 2 separate 3 lecture/week courses, *Natural Gas Processing Principles*, ENCH 607 and *Natural Gas Processing Technology*, ENCH 609. After more than 2 decades, these two courses continue to be amongst the Department's most popular graduate offerings, with Andy Younger coloring his lectures with case-studies from nearly 4 decades of experience in the gas processing industry (see The Silver Anniversary Section of Chapter II and Plate 2.90).

This highly successful start towards petroleum engineering was reinforced by Dr. G.W. Govier's course on *Fluid Mechanics of Complex Mixtures* (Chem. Eng. 588) which, amongst other topics, also dealt with pipeline flow of gas-liquid, liquid-liquid, and liquid-solid mixtures and was, therefore, equally important and of interest to engineers in the oil and gas industry. With experience from 23 years at the U. of A. and activities in the profession and as Chairman of the Alberta Oil and Gas Conservation Board, renamed Energy Resources Conservation Board, he was well equipped to bring relevant examples from the oil patch to his presentations. Although renamed a couple of times and offered by other members of the Department after the 1971-72 academic year, this course also continues to be one of the favourite choices of graduate students and professionals today (1992).

Further impetus was provided by the first two full-time Chemical Engineering appointees, Drs. K. Aziz and D.W. Benning, who joined the Calgary Engineering team on Sept. 1, 1965. Both had background and interest in petroleum engineering topics and the use of computers in their field. Doug Benning started out by offering a new graduate course, *Fluid Flow in Porous Media* (Eng. 687) during the Fall session in which he discussed flow and pressure distribution in finite and semi-infinite reservoirs. At the conclusion of the academic year, he joined forces with Khalid Aziz in offering a 2 week short course on *Computer Methods in Reservoir Engineering*, June 1-3-24

1966, a course which they repeated May 8-19 1967 and June 3-14 1968. Dr. Aziz was also involved in 2 C.M. short courses on *Bottom Hole Pressures in Gas Wells* and *Back Pressure Relationships from Limited Flow Data*, during the spring of 1966, involvement which continued during the next 3 years and developed into a 2 hr/week course on *Reservoir Simulation*, offered by the pair during the 1969-70 academic year for the Calgary Section of the Petroleum Society of C.M. P.S.C.M.

Creation of the Department and PRR

Establishment of the Department on July 1, 1966 and completion and occupancy of the Chemical Engineering Wing (D-Block) 2 months later naturally had a very positive effect on all aspects of the Department's development. This was, after all, the second in a series of buildings to be constructed as part of the Engineering Complex, construction on which had begun almost as soon as the Civil Engineering wing opened. The Head and the academic staff thus could proceed with the planning and equipping of undergraduate and graduate research laboratories.

Petroleum engineering related activity received further stimulus when the newly created *Petroleum Recovery Research Institute (PRR)* was housed on the 3rd floor of D-Block in January 1967. Overlapping professional and research interests among the staff of the 2 units naturally led to exchange of ideas, mutual stimulation and cooperation, thereby creating a beneficial environment which continued beyond December 1979, the date when the Institute moved into its own quarters in the University Research Park.

The strongest impetus, however, was provided by the growing demand from local industry and the profession for courses, programmes and continuing educational opportunities in this field. The few graduate courses being offered were over subscribed which led to the introduction of new courses and the offering of continuing education and special short courses. One of the new graduate courses was *Heat and Mass Transfer in Porous Media*, Eng. 632, introduced by Doug Benning in the 1968-69 Session and offered annually until 1974. A short course on *Natural Gas Processing* was introduced in May 1970 by Andy Younger with the cooperation of Drs. M.F. Mohiadi and E.L. Tollefson. The course was repeated annually usually in April/May until 1980 and involved various groups of staff members, including 2 or more of the following: Drs. N.E. Anderson, K. Aziz, P.R. Bishnoi, G.A. Gregory, R.A. Heidemann, J. Mattar, M.F. Mohiadi, R.G. Moore, W.Y. Svrcek and E.L. Tollefson.

The First Petr. Eng. Programme

The demand for petroleum engineering related courses continued to expand. Therefore, in addition to increasing the number of graduate courses and continuing education/special and short course offerings, the Department decided to introduce an undergraduate course in this specialization. The 1970-71 first major faculty curriculum review provided the opportunity for this programme revision. Amongst other changes, a new course, *Petroleum Reservoir Engineering*, ENCH 523, was offered for the first time in the Fall of 1970 by Dr. D.W. Benning. During the next 2 years, Khalid Aziz took over the lecturing, returning it to Doug Benning in 1973-74, when the course became an option in the 4th year pro-

gramme. He continued as the course instructor until the end of the decade. Drs. F. Stanislaw and P.M. Sigmund became lecturers in ENCH 523 in 1980 and 1982, respectively, and continue to be associated with this course till date (1992).

Soon after its introduction, the course became a favourite for undergraduate and graduate students in Chemical Engineering and students from other engineering departments. By 1979, the demand for the course had grown to the point where it became desirable to offer ENCH 523 in both terms. At the Jan. 23, 1979 Departmental Council meeting it was decided that the Department will offer the course in both terms, with students from outside the Department being registered in the Fall Session of the course and lectures scheduled for 17:00 hrs. During the period 1982-86, for 4 years, the course was offered 3 times annually, including the summer session.

In view of the overwhelming success with ENCH 523, a second petroleum engineering undergraduate course, *Petroleum Production Engineering*, ENCH 533, was added to the 4th year optional courses during the second major faculty curriculum review initiated in 1977. The course was introduced during the fall of 1979 by Messrs. M. Gupta and J. Richardson, as Sessional Instructors. They repeated the course in 1980 and 1981 sharing the lecturing. This course, like ENCH 523, also was an instant success with enrollments exceeding 100 students and requiring 2 sections, one in each term. From 1984 on, Dr. Amir Badakhshan served as lecturer in both sections of the course until Dr. D.M. Belgrave took over this task in 1989.

To accommodate the continuing growth in enrollments in these courses, the Department decided to add a 3rd undergraduate course in this area. In 1988 it began offering 2 separate courses in reservoir engineering, namely *Reservoir Engineering I*, ENCH 523, and *Reservoir Engineering II*, ENCH 525. All 3 courses continue to be favourite choices of students with a substantial portion of the registrants coming from outside the Department.

Parallel to and coupled with this continuing growth in enrollment in petroleum engineering courses, there was an increasing demand for a programme in petroleum engineering with an associated distinct degree. As a first step towards meeting this need the Department decided to introduce an *MEng Programme in Petroleum Engineering*. Discussions on this proposal were initiated during the 1972-73 academic year. The programme was finalized and approved by the Faculty of Graduate Studies for inclusion in the 1974-75 calendar with requirements identical to those of the existing MEng programme in Chemical Engineering except for specification of core courses. Three new graduate courses were added to the Department's existing list of offerings, namely *Advanced Reservoir Eng.*, ENCH 611, replacing *Flow of Fluids Through Porous Media*; *Secondary Recovery*, ENCH 629, eliminating *Heat and Mass Transfer in Porous Media*; and *Reservoir Simulation*, ENCH 641. The success of the programme was underlined by the growing number of MEng registrants during the second half of the 1970's. Also, the Department saw the need to introduce additional petroleum engineering courses or change existing ones. Thus, for example, in 1978-79, ENCH 641 was replaced by 2 courses, *Reservoir Simulation I*, ENCH 624, and *Reservoir Simulation II*, ENCH 644, courses which remained unchanged until the 1992-93 academic year.

when they were, once again combined into a single course, *Reservoir Simulation*, ENCH 621.

The course, *Fluid Mechanics of Complex Mixtures*, ENCH 605, became *Pipe Flow of Oil-Gas Mixtures and Slurries* in 1975-76 and was renamed *Multiphase Flow in Pipes* in 1980-81. A new course, *Thermal Methods of Recovery of Heavy Oils* was introduced in 1979-80 under 619 021 and was given a permanent number (ENCH 647) in 1983-84. During the same year 2 new graduate courses were approved and introduced, *Fire Flooding I* and *Fire Flooding II* (as 619 03 and 619 04) which became the single course, *Fire Flooding*, ENCH 649 in 1986-87. The course on secondary recovery was expanded and renamed *Secondary and Tertiary Recovery* in 1980-81 and ENCH 611 was changed the following year from *Adv. Reservoir Eng to Adv. Well Test Analysis*. New courses, entitled *Engineering in the Petroleum Industry* and *Horizontal Wells for Petroleum Production* were introduced in 1984-85 and 1991-92, respectively, and assigned permanent course numbers subsequently, ENCH 651 & 653. The MENG Programme in Petroleum Reservoir Engineering stands as one of the Department's favourite graduate specializations after nearly 2 decades in operation thereby justifying its introduction and underlining the continuing demand for this type of programme.

AOSTRA and CMG

The creation of the crown corporation, the *Alberta Oil Sands Technology and Research Authority*, AOSTRA, in 1974, and the establishment of the non-profit organization, the *Computer Modeling Group*, CMG, in 1977 were events which had a most positive influence on the development of the Department, particularly its petroleum engineering programmes and activities.

As we saw in Chapter III, AOSTRA became one of the primary research funding agencies for a large segment of the Department's academic staff. During the 17 year period, 1975-92, it provided nearly \$6.0 million in the form of research grants and contracts and supported the research and graduate work in Chemical and Petroleum Engineering through two 5-year AOSTRA Professorships and 37 one year graduate scholarships and a post doctoral fellowship. The cumulative beneficial effect of this support on the Department's programmes is beyond precise assessment.

The CMG like PR influenced the petroleum engineering related activities of the Department in a more subtle less direct manner. Its director, Khalid Aziz, retained his Professorship in the Department and continued to be involved in its teaching, research and professional activities until 1982. The staff of the Institute was cooperating with the academics in Chemical and Petroleum Engineering on various research projects and was involved in the teaching of graduate courses. For example, the 2 reservoir simulation courses were offered on a number of occasions by the staff of CMG. Throughout the 1980's, the Department was fortunate to have staff members from CMG, PR and from industry including Drs. J.P. Batičky, D. Best, J. Novosad, J. Richardson, S. Sayegh, A. Settar and A.H. Younger willing to help in offering various petroleum engineering related courses. Involvement of many of them continues today. 1992

The Name Change

As we saw above, the growing demand for instruction in petroleum engineering led to the introduction of an undergraduate course and graduate courses sufficient for the launching of an MENG programme in this specialization in 1974. Then came the recognition of the in-Situ Combustion Research Group, ISCGR, by AOSTRA in 1976-77 through a 5-year \$550,000 research contract and an AOSTRA Professorship to the senior member of the Group, Dr. D.W. Binnion. And the demand for educational opportunities in this field contin-

ued to increase. Naturally, more and more time of certain staff members and a certain portion of the time of an increasing number of staff in the Department was spent on petroleum engineering related teaching and research. It was not surprising, therefore, that during the latter part of the 1970's, various suggestions were put forward by academics in Chemical Engineering designed to give recognition and visibility to this activity. Thus, for example, Doug Binnion suggested in a letter addressed to the Head of the Department during the summer of 1978, the establishment of a *Petroleum Engineering Division* within the Department of Chemical Engineering. When this matter was brought before Departmental Council for discussion on Sept. 15, 1978, Khalid Aziz suggested a Committee to examine it as part of the Department's programmes. The *Ad-Hoc Committee on Petroleum Engineering* was established at that meeting and consisted of Drs. Aziz, Binnion, Gregory (Chairman) and Swick.

The first written record about the name change the writer found was in the minutes of the Departmental Council meeting of Dec. 5, 1978. The Dean was invited for a discussion on the need for expansion of the Department. At the end of that discussion, Dr. Barton is reported to have stated that "it might be a worthwhile suggestion to change the department's name to *Chemical and Petroleum Engineering*".

The next time the name change issue was raised in Departmental Council was on Feb. 1, 1980 when the Chairman of the *Committee on Petroleum Engineering*, Dr. Gregory, circulated a Resolution on changing the Department's name to Department of Chemical and Petroleum Engineering. Justification for this change was the number of courses offered by the Department in the petroleum engineering field. The Resolution was approved and Dr. Gregory was asked to present it at the next EFC meeting.

At the Feb. 20, 1980 meeting of Engineering Faculty Council it was on a motion by Drs. D.W. Binnion and K. Aziz that the Department's name change was approved "in recognition of the substantial level of activity of its members in teaching, research and professional affiliation related directly to Petroleum Engineering". The Dean forwarded the approved Resolution to the V.P. (Academic) who returned it to the Department with a request for a preamble, as Dr. Gregory reported to his colleagues at the March 7, 1980 Departmental Meeting. The name change was finally approved at the May 15th meeting of the Board of Governors, after the Policy and Planning Committee, PPC, and General Faculties Council GFC, had approved it on April 3 and April 24, respectively. The name change to the *Department of Chemical and Petroleum Engineering* was to be effective immediately, i.e. as of May 15, 1980.

The Petroleum Engineering Chair

Changing the name of the Department was but one of a number of petroleum engineering related developments actively being pursued during the late 1970's by Eric Toffelson and his colleagues. One of these departmental goals was the establishment of an endowed Chair in Petroleum Engineering, an idea supposedly first suggested in the mid-1970's by members of the Executive of PSCIM. The idea was developed into a concrete proposal and was championed by Mr. W.R. (Bob) Porteous during his Chairmanship of the local section of PSCIM in 1978-79. The proposal was first discussed officially in the Faculty at a meeting of the *Faculty-Industry Advisory Council* on Tuesday Nov. 6, 1979. According to Dean Barton's letter to President N. Wagner dated Nov. 9, 1979, the proposal was enthusiastically received by the industrial members of the Council as both appropriate and opportune.

In his response of Nov. 23, 1979, the President agreed with the Dean and promised his support

for the project. He noted that a position paper defining institutional policy regarding the establishment of chairs at The U of C is in the discussion and approval stage.

The Department was quick in its reaction after the President's reply. Only 3 weeks later the Head submitted the *Proposal for the Establishment of a Chair in Petroleum Engineering within the Department of Chemical Engineering*, dated Dec. 14, 1979 to the V.P. (Academic), P.J. Krueger and to the Dean. On Dec. 10th 4 days earlier Dr. Barton had visited at the Departmental Council meeting where he is reported to have stated that "the Chemical Engineering building extension, the petroleum engineering BSc programme and a Chair for Petroleum Engineering are politically 3 different subjects. From the Department's point of view they can be considered one but with this approach considerable difficulties may be encountered. It is of interest to note that in the Dean's presence only the question of the Chair was discussed with consideration of the BSc programme proposal and the building extension left for another meeting". No record of a further discussion with the Dean at a Departmental Council meeting was found by the writer.

Approval of the Proposal was somewhat delayed due to the position paper on Chairs being discussed and approved. Suggestions for changes and improvements by the V.P.'s (Academic and Research) led to a revised version, dated April 2, 1980. Then, after endorsement by PPC on April 3, 1980 the Chair Proposal was approved, in principle, by the Executive Committee of GFC, by GFC and by the Board of Governors on June 3, 12, and 26, 1980, respectively. In giving its approval, the Board requested recommendations from the Office of University Resources and Community Relations, Mr. S.G.A. McKinnon, Director regarding the feasibility of raising the necessary funds for the endowment.

On July 8, 1980 Mr. Frank Doucette, Director of Fund Development contacted Dean Barton requesting suggestions for Chairman and for members of a *Fund Raising Committee*. The Dean passed this request to the Department where Dr. R.G. Moore was asked to provide a list of names. Gordon Moore was particularly well qualified for this task since he had been involved in the activities of the local section of PSCIM for a decade and had just finished serving as Chairman of the Society during 1979-80. His suggestions for Chairman and membership of the Committee were transmitted by the Head to Stuart McKinnon in a letter dated July 25, 1980.

Establishment of the Fund Raising Committee and finding a Chairman for the Committee took several months. It was on April 6, 1981 when Mr. S. Keith McWalter, President and Chief Executive Officer of Gulf Canada Resources Inc. and Chairman of the Committee met with Stuart McKinnon to discuss a fund raising strategy. Details of the fund raising programme were worked out during the summer and the programme submitted to and approved by the Board at its meeting on Sept. 17, 1981. The membership of the Committee was also finalized before the *Organizational Kick Off Breakfast* meeting held right after Labour Day, the week of Sept. 7, 1981 and included the following: Messrs. J.M. Beddome, Senior V.P. Dome Petroleum Ltd., C.W. Dumett, President Union Oil Co. of Canada, A.R. Nielsen, President Canadian Superior Oil Ltd., D.G. Stoneman, Senior V.P. Shell Canada Resources Ltd., G.L. Henderson, President Chevron Standard Ltd., D.R. Motyka, V.P. Frontier of Gulf Canada Resources Inc., W.R. Porteous, President T.T. Geotechnical Resources, W.H. Rimmer, Asst. to President, Texaco Canada Resources Ltd., M. Stewart, Executive V.P. Nova Mel Gray V.P. and G.M. Schlumberger of Canada Ltd. The Department was represented on the Committee by Gordon Moore.

The fund raising drive kicked into high gear immediately after Board approval was obtained with the first major donation occurring only 4 days into the campaign, on Sept. 21, 1981 (see Plate 3.52). By the end of October, more than 50% of the targeted \$0.6 million had been received. On Dec. 11, 1981, donations totalled \$0.493 million with an additional \$0.11 million in pledges. Thus the goal of the fund drive had been achieved in less than 3 months.

Total donations exceeded the targeted amount by more than \$230,000, with more than 80% of the funds coming from 35 major companies in the petroleum industry. Of the \$0.83 million received, \$0.75 million was used to form the endowment and a \$75,000 donation from Bechtel Canada Ltd. with an equal matching grant from the Province, were allocated for the establishment of the S.M. Blair Memorial Laboratory in the Department. The interest from the endowment was also matched by the government for a 10 year period. The fund drive for the Chair in Petroleum Engineering was thus one of the most successful campaigns undertaken on behalf of the university and underlines the efficiency and effectiveness of the campaign strategy designed and implemented by senior executives from industry.

Advertisements for the Chair position were placed in the spring of 1982 and after the establishment of a further Committee, the files of the applicants were reviewed, a short list of candidates established and ultimately in 1983, Dr. Roger M. Butler selected as the inaugural holder of the Chair in Petroleum Engineering at The U. of C. Roger Butler joined the Department on Nov. 1, 1983, and was reappointed for a 5 year term on July 1, 1989.

The Petr. Eng. BSc Programme

With continuing growth in demand for petroleum engineering educational opportunities and the success of the MEng Programme in Petroleum Reservoir Engineering, approved in 1973-74, it was to be expected that discussions concerning a BSc Programme in Petroleum Engineering would develop during the second half of the 1970's. The event which triggered action on this matter was Doug Bennion's letter to the Head which was discussed at the Departmental Council meeting of Friday, Sept. 15, 1978. The Ad Hoc Petroleum Engineering Committee, which was established, was charged with the task of studying and bringing forth recommendations on possible petroleum engineering programme developments.

An initial draft proposal for an undergraduate programme in petroleum engineering was presented by Gary Gregory to the Department at its meeting on Feb. 27, 1979, when 4 of its major recommendations were approved in principle. Questions raised at the meeting concerned the space shortage existing in the Department and the necessity of additional space before any new programmes are implemented. This suggestion ultimately led to the coupling of this programme proposal with a proposal for extension of the Chemical Engineering wing, a strategy by which Civil Engineering finally succeeded in getting its building extension approved in June, 1979, along with the BSc programme in Surveying Engineering. The Committee was also asked to bring back recommendations for a graduate programme in petroleum engineering.

A revised proposal for a BSc programme was presented at the Sept. 17, 1979 Departmental Council meeting. During the lengthy discussion which followed, issues raised ranged from establishing a separate Dept. of Petroleum Engineering or Dept. of Energy Resources Engineering, to the requirements of a joint Dept. of Chemical and Petroleum Engineering. In the end, the Committee was asked to revise its proposal so as to include a minimum of 75 and a maximum of 100 students in each year of the combined programme, with various distributions in the Chemical and Petroleum Engineering options.

A final version, the so-called white paper on the BSc programme proposal was brought before the Department on Dec. 3, 1979. During its discussion it was suggested by Gordon Moore that the approval process, both within the institution and at government levels would be accelerated and facilitated through support from PSC M. Bob Heide-mann felt that the support of CIM and APEGGA would also be helpful. It was therefore decided to submit the proposal to the PS and request their comments and support. The white paper was approved and the Committee was instructed to discuss it with Dean Barton.

At the meeting of the Departmental Council on Feb. 1, 1980, Drs. Aziz, Bennion and Moore reported on their meeting with Mr. W.R. (Bob) Porteous, Past Chairman of the local section of PS, who found the programme proposal to be excellent in all details and promised strong support from the Society.

Details of the programme proposal were revised during the spring and summer of 1980, taking into account comments from the Dean and the Academic Review Committee. At Engineering Faculty Council on June 19, 1980, the question of a Letter of Intent for a BSc Programme in Petroleum Engineering was raised by Dr. M. F. Mohtadi with no decision taken by Council. It was on Sept. 18, 1980 that the preparation of a Letter of Intent for such a programme was formally approved by EFC, on a motion by Drs. Tollefson and Gregory.

As reported by the Head at the Feb. 20, 1981 Department Council Meeting, the Letter of Intent was drafted and sent to the V.P. Academic in January 1981 in response. Dr. P.J. Krueger suggested certain changes and advised the Department to proceed at full speed with the development of the detailed programme proposal. The Vice President also suggested contacting the V.P. (Services), Dr. H.A.R. dePawa concerning space requirements, the Associate V.P. (Finance), Mr. J. Hamilton for budget details and the Chief Librarian, Mr. A. McDonald for library costs. The revised Letter of Intent, dated Feb. 26, 1981, was approved by PPC and GFC Executive on Feb. 26 and March 17, 1981, respectively, and sent to the Minister before the Board received it for information on March 24, 1981. Approval to proceed with the detailed programme proposal was received from Advanced Education in June, 1981, by which time the change over in the Department's senior administrative position was only days away.

It took a full year for the new Head to prepare a draft of the detailed programme proposal which he mailed on July 30, 1982 to the Dean, to Mr. Hamilton, and to Dr. dePawa for comments and suggestions. After feedback and revisions, the BSc Programme proposal in Petroleum Engineering was approved by the Department and by EFC on Nov. 23, and on Dec. 2, 1982, respectively. Further revisions suggested by EFC, the Academic Review Committee, the Dean, Mr. Hamilton and the V.P. Academic were incorporated in December 1982 before final copies were sent early in 1983 to the Institutional Policy and Planning Committee, PPC, and to the Curriculum and Academic Review Committee, CARC, of GFC.

The proposal was approved successively, by CARC, IPPC, GFC and the Board on March 1, March 11, April 28 and May 19, 1983, respectively, and was mailed soon after Board approval to the Department of Advanced Education and Manpower, DAEM. As submitted, it called for first admissions into the 3rd year of the new programme in the Fall of 1984 and was designed for 40 petroleum engineering graduates per year at steady state of programme operation. Implementation of the programme was made conditional on the availability of additional resources, including staff, laboratory equipment, operating funds and the construction of the Chemical Engineering Wing Extension for the provision of the required additional space. The proposal is with DAEM now

called DAE and awaits funding approval. After nearly 10 years, the likelihood of such approval forthcoming in the near future is minimal, especially in light of current 1992-93 economic conditions in the Province.

The Chemical Engineering Extension

The first proposal for an extension to the Chemical Engineering Wing, D-Block, was made in 1967 before the Mechanical and Electrical Engineering Wings were completed. It was based on enrollment increases and growth in staff which exceeded projections by a substantial margin during 1963-66. It was, therefore, prudent to initiate planning for expansion of the initial facilities. To carry out this task, Dean A.M. Neville appointed an Ad Hoc Faculty Planning Committee on Nov. 14, 1966 under the chairmanship of Dr. Douglas H. Clyde Assoc. Prof. of Civil Engineering. The Committee completed its task within 3 months, prepared and submitted a report dated Feb. 28, 1967. Based on this study, Adam Neville wrote his final major development document for this Faculty entitled *Proposal for Stage II Development of the Engineering Complex*, dated March 7, 1967 in which he made a number of recommendations to the university's Academic Planning Committee, APC, including:

- confirmation of the overall expansion plan of the Engineering Complex, involving some 15,200 assignable sq. ft. (ASM 164,000 sq. ft. net) for 1980 saturation
- authorization of immediate start of detailed planning by APC and the construction (by the Board of Governors) of an extension to the Civil Engineering Wing, 2600 ASM (28,000 sq. ft. net) with occupancy for fall of 1969
- approval, in principle, and authorization for preliminary planning, subject to later review of an extension to the Chemical Engineering Wing, 3,000 ASM (32,000 sq. ft. net) with 1971 occupancy date

The proposal also notes that our initial facilities were designed for saturation by 1972 with 861 undergraduate and 80 graduate students, 47 academic and 32 support staff. Growth in graduate study and research exceeded the projections used in the design so that saturation for the Faculty as a whole was expected before 1971 and for Civil Engineering by 1969.

After Adam Neville resigned his administrative position in the spring of 1968, Dr. R. A. Ritter, the Head of Chemical Engineering, was appointed Dean, effective July 15, 1968. His successor became Dr. M.F. Mohtadi, who within 2.5 months after his appointment submitted a report entitled *Proposal for Extension of the Chemical Engineering Wing*, dated Oct. 14, 1968, which was approved by APC on Oct. 25, 1968.

From then on, the approval process took progressively more time. Approval by the Capital Development Committee, CDC, of the Board took over 4 months after which several months were spent in clearing it through the Universities Commission. In his 1969-70 annual report, Dean Ritter stated that planning for the Civil and Chemical Engineering expansions was proceeding slowly due to lack of funding.

The next move on the Chemical Engineering Extension occurred in the spring of 1971 according to Mait Mohtadi's comments in his last departmental report as Head, dated May 5, 1971, which reads: "Plans for the extension of the Chemical Engineering Building were revived towards the end of the academic year and it is anticipated that consultation with the architects will begin shortly and that preliminary sketches of the new building will be available by January, 1972."

The project was indeed revitalized under the Chairmanship of Dr. John K. Donnelly, the Chemical Engineering Department Building Committee prepared a document, *A Programme for the Extension of the Chemical Engineering Wing*, dated

August 1971 which was approved by the Capital Resources Policy Committee, CRPC, of the University at its meeting on Sept. 2, 1971, by passing the following motion: That CRPC approve the programme for the extension of the Chemical Engineering Wing and forward it to the CDC of the Board for assignment to an architect and preparation of sketch plans and detailed cost estimates.

At its 58th meeting on Oct. 5, 1971, CDC approved the following motion: That the program for the extension of the Chemical Engineering Wing, August 1971 covering 33,230 m² be approved. At the same meeting CDC appointed Bearson Finlayson Architects as prime consultant for the project. Detailed drawings for the Extension were available in December 1972 with a formal design proposal for the Chemical Engineering Extension 1971 being submitted to the university in March 1973. In its Programme the Departmental Building Committee optimistically states that the space is scheduled to become available to the Department of Chemical Engineering in April of 1974. By the time the detailed design proposal was submitted, government financing had all but dried up for new capital projects in this province with a complete freeze being imposed only 2 years later in 1975. Both the Civil Engineering and the Chemical Engineering Extensions were delayed until the required resources were no longer forthcoming.

On Tuesday Dec. 5, 1978, Dean T.H. Barton visited the Departmental Council meeting to discuss the need for expansion. The record 1st year enrollment in 1975 had dramatically increased total undergraduate student numbers which resulted in severe overcrowding of the Faculty's facilities. The Dean suggested an enrollment limit of 60 students in the senior year for each department. During the discussion it was pointed out that an increase in the 4th year enrollment cannot be accommodated without an increase in funding, staff and extra space since the current registration already exceeds the Department's design capacity quite substantially.

The problem of space shortage surfaced again when the first draft of the Petroleum Engineering BSc Programme Proposal was being discussed on Feb. 27 1979. Specifically some members questioned the rationality of even considering the introduction of a new programme with the current facilities. At the Dec. 3, 1979 Departmental Council meeting, after approval was given to the white paper on the BSc programme proposal, a motion was passed calling for the preparation of a report on the Chemical Engineering Extension by the end of January 1980.

In response to this motion, Bob Heidemann, as Chairman of the Departmental Planning Committee, presented a table on space requirements at the Departmental Council meeting on Feb. 1, 1980. During its discussion, it became apparent that staff members present felt the time to be optimum for a proposal for the extension of D-Block to be submitted. Khalid Aziz, for example, suggested that strong proposals for both the BSc programme and the Chemical Engineering extension be put forward as a package. At the next Departmental meeting on Feb. 22, 1980, the chairman of the Planning Committee submitted a draft proposal on the building extension, outlining existing and future space needs and concluding with a strongly worded motion demanding that the D-Block extension be given highest priority in the university. The report was to be transmitted to the Dean and to the appropriate university committees and officers.

At the March 21, 1980 Departmental Council meeting it was reported that no feedback had been received from the Dean on the building extension proposal.

No further specific action was taken by the Department on the proposal for extension of the Chemical Engineering Wing, especially since Civil Engineering had obtained approval for their new building by coupling that request with the proposal for the

new Surveying Engineering BSc programme. It was therefore decided to use the same approach and make the implementation of the new Petroleum Engineering BSc programme conditional on the construction of the extension to D-Block.

With the new Civil Engineering building under construction after January 1981, the oil-patch boom nearing its apex and DAEM officials being sympathetic and encouraging with regard to expansion of engineering facilities at both campuses, optimism about building extensions was running high in the Faculty (see the Towards Goals section of Chapter III). The Dean and the Head of Electrical Engineering, Dr. G.S. Hope, asked the Director of Campus Development, Mr. I.W. Duncan, for an outline of the current thinking in regard to expansion of the Engineering Complex. In his response, dated Feb. 5 1982, Ian Duncan listed extensions to the D-Block, the C-Block and B-Block, together with a proposed new Computer Engineering/Science Building. The addition to the Chemical Engineering Wing was listed first, described as a 5 storey-plus basement extension 25 x 45 m in plan, providing 6,750 GSM (gross square meters) or 3,970 ASM. A sketch of the Engineering Complex, showing the planned extensions and the new Engineering/Science Building was attached to his memo, which was addressed to Dean Barton and copied to the Dean of Science, Dr. T.A. Oliver and to the V.P. (Services), Dr. H.A.R. dePaiva. A further memo on 'Expansion to the Engineering Complex from the Director of Campus Development' dated July 21, 1982, to Tom Barton also states that the Faculty's (the Dean's) first priority in the spring of 1982 was the Chemical Engineering Extension. Since by July 1982 the economy had turned 180° from boom to recession, Ian Duncan was prefacing his remarks by statements like 'while we have some breathing time and hope you have time to reassess the Chemical Engineering proposals. No one suspected then just how much time there really would become available for reassessment.'

By the time the BSc programme proposal had finally been cleared through the institution and been submitted to DAEM in May 1983, the period of *law in the freeze* on capital construction had passed and any *windows of opportunity*, which might have been open, had been shut tight again.

As one might have expected, there was no response forthcoming from Advanced Education on the BSc programme/building extension proposal. After a 2 year wait, the Department decided in 1985 that the prospects of receiving the green light on this project might be improved by grassroots support from industry. A lobby was therefore undertaken to obtain support for a fund-raising drive for the construction of the Chemical Engineering extension. With the help of members of the Calgary Section of the Petroleum Society of C.M. and the national body of C.M. itself, the Department contacted key segments of local industry during 1985-86. On the basis of this campaign it was concluded that a fund-raising drive for obtaining half the cost of an extension to D-Block would be successful, despite the generally poor economic conditions prevailing in Alberta's energy sector at the time.

A sluggish economy was but one of the obstacles facing the Department in getting institutional approval for a fund-raising undertaking. This was, after all, the start-up period for the 1988 Winter Olympic games. The institution was totally focused on and committed to this event and senior administration did not want to consider any initiative which might interfere with or divert resources from the preparations for the games. Also, since the province had contributed quite generously towards the cost of construction of games-related facilities on campus, the likelihood of obtaining further major funding for capital projects prior to the completion of the games was considered to be very small.

Within the Faculty a problem of priorities surfaced suddenly in 1986. The Department of Civil En-

gineering, in cooperation with the Faculty of Management, had done their own survey of industry and found a very positive response for funding of an expansion of the Project Management initiative and the establishment of a Chair in Project Management. They were requesting immediate approval of a fund-raising drive for a \$1.7 million endowment.

At the June 17, 1987 EFC meeting a compromise was agreed to and the Chemical Engineering extension and Project Management expansion projects combined into one Engineering Faculty proposal. It was this Faculty of Engineering endowment and capital fund raising campaign proposal which was approved, in principle, by the Board of Governors on February 18, 1988, during the Winter Olympic Games. The proposal included:

- i) \$7.5 million capital funds for the Chemical and Petroleum Engineering Wing extension, 6,000 GSM
- ii) \$0.5 million endowment funds for the establishment of an Engineering Energy Library
- iii) \$1.7 million endowment funds for the expansion of the existing program and the establishment of a Chair in Project Management

In approving the proposal, the Board requested the preparation and submission of a fund raising strategy before the campaign begins. Approval was given on April 28, 1988 to a preliminary fund raising strategy which was subsequently revised and was finally approved on April 20, 1989. Government commitment to matching the capital funds portion of the proposal was also slow in coming and had not been received by the end of 1988.

With the fund-raising drive approved, the Department was able to get, once again, architectural drawings, prepared by the Cohos Evans Partnership and dated Sept. 16, 1988. It appeared that the Chemical Engineering Extension was finally becoming reality after more than 2 decades.

The start of fund-raising was delayed into 1989 and was then held up during the university's initial planning for a major fund-raising drive in connection with the silver anniversary. This undertaking was designated the *Building on the Vision* campaign into which an engineering capital and endowment fund raising drive was, in due course, incorporated.

As noted in Chapter III, with the appointment of Dr. E. Rhodes as Dean on July 1, 1990, the Department's optimism with regard to its future and its goals was heightened. In the winter of 1991, the new Dean was instrumental in bringing the stalled negotiations with Petro-Canada concerning the leasing of their facility north of the Engineering Complex, immediately across 32nd Ave., to a successful conclusion. The new building, leased for 10 years, was assigned by the university to the Faculty and, in turn, by the Dean to Mechanical Engineering. The space vacated in B-Block was renovated and turned over to the Department in July 1992, in lieu of an extension to their wing. Thus the joy of having some relief from the space crunch under which the Department operated for many years was clouded by the loss, once again, of the opportunity to have their dream become reality.

Only time will tell whether the new proposal for an Administrative Wing across the south end of the engineering courtyard with an enclosed engineerium, replacing the present open space, will materialize. If this proposal which effectively shelves the Chemical Engineering extension for the foreseeable future. The financial outlook for the university for the next few years, as outlined by President Murray Fraser on Jan. 21, 1993, is any thing but encouraging. Thus, it is by no means certain that this, or any other addition to the Engineering Complex will be built during the remainder of this millennium. Irrespective of what happens, the blank walls at the ends of a couple of wings of our Complex will continue to be sores to the eye, begging for completion of the originally planned extensions. Hopefully the need for additional facilities and the province's fortunes will be such as to allow such construction to take place soon.

APPENDIX F

DEVELOPMENT OF THE PROJECT MANAGEMENT PROGRAMME AT THE U OF C

Introduction

The decade of the 1970's was for most of Alberta and for Calgary a period of economic boom. Construction, both commercial and residential as well as oil and gas exploration and production reached record high levels. It was also the time of planning and initiating heavy oil and tarsands megaprojects. All of that activity demanded professionals with experience and expertise in construction management and planning, scheduling and project management in general. That demand, in turn, focused attention on the need for university level courses and programmes in these specializations. It so happened that there was interest within the institution in initiating such programmes and consequently a number of faculties and departments decided to meet that challenge during the late 1970's and early 1980's.

Early Activities

Course offerings in construction management by engineering academics was initiated by Dr Robert E. Loov. Responding to a perceived need, he offered a 2 day short course on Critical Path Methods, CPM, Feb. 18-19, 1974. The course was so successful and so heavily oversubscribed that it had to be repeated 2 months later. With continuing demand, this 2 day short course was repeated on May 13-14 and June 11-12, 1975, on Nov. 15-16 and Dec. 13-14, 1976, and on Nov. 16-17, 1977. He also offered one day seminars on CPM to the staff and students of the Faculty of Environmental Design on Feb. 2, 1977 and on March 14, 1979, respectively.

Encouraged by the popularity and success of his courses, Bob Loov expressed the opinion at the March 8, 1979 Civil Engineering Departmental Council Meeting that Calgary was rapidly becoming a centre for construction management. He suggested that the Department should consider the possibility of establishing a specialization in this area, a suggestion which was unanimously approved by Council. The Chairman, Dr. Michael A. Ward was particularly supportive of the idea and appeared to be personally interested in pursuing this matter. He had just expanded his contacts with a large local firm 3 days earlier which appeared very promising and which was to develop into a major contribution to the Department's construction management course offerings.

There were a number of additional developments and initiatives during the mid-and-late 1970's which underline the Department's growing interest and involvement in construction management related educational activities. Topics in this field were introduced through changes in course content of existing courses and by adding new courses to the list of undergraduate or graduate offerings. A major faculty-wide curriculum review initiated in 1977 and involving both common core and departmental programmes, facilitated such changes. For example, the 4th year optional common core course, ENGG 503 — *Operations Research*, a course which had been introduced into the engineering curriculum in Sept. 1971, was modified by replacing some of its traditional, more analytical material with new practically oriented topics, such as project planning and control and the use of CPM and Project Evaluation and Review Technique, PERT in

scheduling. The revised course outline first appeared in the 1977-78 calendar.

In the Department of Civil Engineering, the curriculum review resulted, amongst other changes, in the introduction in the Fall 79 session of a new course, ENC 471 — *Civil Engineering Systems* offered by Dr. Ian J. Jordaan. It included decision theory, queueing theory, the CPM and PERT techniques in construction scheduling, with applications from various civil engineering sub-disciplines. A 4th year optional course, ENC 501 — *Civil Engineering Design*, which was a design project course, was used as a vehicle to introduce various practical engineering topics and provide an opportunity for the student to interact with practicing professionals. Thus, during the 1976-77 and 1977-78 academic years, when Ian Jordaan was the course coordinator and lecturer, a number of guest lecturers from the profession were presenting construction management related case studies/histories from recent practice. In addition, the course coordinator lectured on decision theory and its application to construction management. During the 1977-78 curriculum review it was decided to phase out this course. It was scheduled for the last time during the Winter '80 session.

The Local Chapter of PMI

A 1979 downtown initiative which is relevant and significant to the development of our project management programme was the formation of an Alberta Chapter of the Project Management Institute-Int'l., the head office of which is located at Drexel Hill, Pa. Initial activity concerning such an undertaking began in May 1979, when after two enquiries to PMI, Mr. Bruce A. Martin spearheaded the formation of a *Steering Committee* members of which included Messrs. Klaus D. Zahnd, J. Owen Hachey, Ronald D. Nelson and two of Bruce Martin's colleagues at work, Messrs. Willy J. Brusse and William H. Wise. Their first meeting was held Aug. 15, 1979 in the Weston Hotel's Owl's Nest while the second time they met at Mr. Martin's office on Thursday, Sept. 13.

With the spring 1979 membership list of PMI indicating over 60 Alberta members, 2/3 of which resided in the Calgary area, the Committee decided to call an initial organizational meeting, for 7:00 P.M. on Thursday, Sept. 27, 1979 in the *Pratt Room* of the Macleod Tr. S. Holiday Inn. The meeting was chaired by Klaus Zahnd with 24 individuals, including 15 Edmonton PMI members and 7 non-members present. It was decided to proceed with the establishment of an Alberta Chapter. A second, so called "kick-off" meeting was held at the same location on Oct. 25, 1979 again under the chairmanship of Klaus Zahnd and with 31 participants. Elections conducted by Mr. Warren E. Allen, determined the first interim Board of Directors of the proposed Alberta Chapter of PMI as follows: President Bruce A. Martin; v.P. (Calgary) Klaus D. Zahnd; v.P. (Edmonton) Richard R. Taylor; Secretary Ronald D. Nelson; Programme Chairman: J. Owen Hachey; Membership Chairman: Gary D. Lavold. Present at that "kick-off" meeting also were Messrs. Robert G. Holland and Leonard H. Pakulak, both of whom were to become Presidents of the local chapter of PMI. The application for charter was submitted on Nov. 8, 1979 by Bruce Martin.

At the annual meeting of the proposed Alberta Chapter held April 9, 1980 at the Calgary Professional Club, a new Board was elected as follows: President: Gary D. Lavold; Past President: Bruce A. Martin; v.P. (Calgary): Klaus D. Zahnd; v.P. (Edmonton): Richard R. Taylor; Secretary-Treasurer: Ronald D. Nelson; Programme Chairman: Tony W. Goldsmith; Membership Chairman: John Schultz. As President, Gary Lavold attended the Spring Annual Meeting of the Board of Directors of PMI-Int'l., held April 17-19, 1980 at the Hyatt Regency Hotel in Phoenix where the application for an Alberta Chapter was approved. He also attended the Fall Annual Board Meeting and Seminar/Symposium of PMI, Oct. 27-29, 1980 again at the Hyatt Regency in Phoenix where he was presented the Charter of the Alberta Chapter with Bruce A. Martin's name inscribed on it as Trustee. A recommendation his Board of Directors had made earlier in the year in recognition of the leadership shown by Mr. Martin during the formative stages of the Chapter. A second significant event during Mr. Lavold's 2 year presidency was the submission on March 27, 1981, of a revised constitution changing the name of the Chapter to the *Southern Alberta Chapter of PMI*, after an application for a Northern Alberta Chapter had been prepared and submitted by the Edmonton members of PMI-Int'l.

At the Feb. 3, 1982 meeting of the Board of Directors, Gary Lavold chose to be nominated only as Past President, making way for Robert G. Holland to be elected President in 1982 with Ronald D. Nelson serving as v.P. In 1983 Len H. Pakulak was elected v.P. becoming successor to Bob Holland in 1985.

The Fluor Connection

As a major employer of engineering graduates Fluor Canada Ltd. was arranging annual receptions for the engineering graduating class during the late 1970's and early 1980's. It was at such a reception at Fluor on Monday, March 5, 1979 that Dr. Michael A. Ward was continuing to build his Department's contacts within Fluor which had been established, at the Company's initiative, during the preceding 12-18 months. Mike Ward had met with their senior management to explore the possibility of obtaining support, both manpower and financial, from industry to help launch undergraduate and graduate engineering course offerings in project/construction management, planning, scheduling and cost engineering. The company officials were very enthusiastic and supportive of such an undertaking. At this reception he met Mr. R. J. Dick, Parker General Manager, Project Operations at Fluor, with whom he had a long discussion and seemed to have hit a responsive chord. It was with the support of Dick Parker and other senior Fluor executives, including Mr. A.B. (Sandy) McArthur, future president of the Company, that Mike Ward was able to establish a cooperative link with Fluor, the *Fluor Connection*, which was to last for several years and facilitate the inauguration of construction/project management related instruction within Civil Engineering.

An immediate problem facing the Department Head during 1979 was the staffing of the Civil Engineering course offerings which had been increased during a faculty-wide review. The imple-

mentation of which was begun in the 1979-80 academic year. He could find no one but himself to look after the project course ENCI 501, which was to be offered for the last time during the winter '80 term. After assigning the course to himself he recognized that it provided an opportunity to set in motion the collaboration with Fluor Canada Ltd. which he had been negotiating for since 1977. With the support and approval of Dick Parker, Mike Ward and Bob Loov began discussions on September 26, 1979 with Mr. Fumio Otsu concerning lecturing on cost engineering topics during the winter term. Before the year was out and after a number of additional work-sessions at Fluor, Mr. Otsu was ready to start lecturing on January 8, 1980 with Dr. Ward looking after the topics on scheduling. Progress was monitored throughout the term through regular monthly luncheon meetings with the lecturers and Ian Jordaan present. Before the course was completed it was clear that this initial experiment in offering a course with staff from Fluor was a highly successful and popular undertaking with 63 students enrolled in this 4th year option.

Encouraged by the positive response from the students, the Department decided at its meeting on May 14, 1980 to introduce a new optional course ENCI 503, *Introduction to Cost Engineering*, starting in the Fall '80 term. In addition, a course on Project Management was to be added to the Department's list of graduate offerings for the 1980-81 academic year. The chairman agreed to pursue this option with Mr. Parker.

Engineering Faculty Council, EFC, at its meeting of June 19, 1980 did not approve the Department's plan to offer ENCI 503 in the Fall term. During the discussion, council members suggested that such a course on Cost Engineering may be of interest to students across the Faculty and should therefore be introduced under an ENGG rather than an ENCI number.

The Department was determined not to let this slight set-back slow down the momentum generated by the Fluor involvement in ENCI 501. Plans were in place for Mr. Giovanni M.A. Ferrara (since Mr. Otsu was not available) to offer a course in each of the Fall and Winter terms of the 1980-81 academic year. It was decided to proceed in accordance with these arrangements, thus offering both a *Cost Engineering* and a *Construction Planning and Scheduling* course under 6.9 xx numbers (see Table F 1). In addition, even though on sabbatical leave, Mike Ward had several meetings during the Fall of 1980 with Fluor to finalize details for the common core course ENGG 505 — *Intro to Cost Engineering* which was

approved and offered for the first time in the Fall of 1981 by Fluor staff. Bob Loov and Allan Torvi from Mechanical Engineering were involved in some of these discussions, including a meeting on Oct. 31, 1980. During the Spring and early summer of 1981 arrangements were finalized for the offering of 3 courses during the 1981-82 session by Fluor (or former Fluor) personnel. David A. Williams was scheduled to lecture in ENGG 505 while Dick Parker agreed to offer a graduate level *Construction/Project Management* course for the first time. Douglas J. Warne, who had moved from Fluor to Parter Lavalin Inc. a few months earlier, taught the *Construction/Project Planning and Scheduling* course during the Winter '82 term (see Table F 1).

After his sabbatical leave, Mike Ward continued to build and plan the project management programme of the Department. In a letter to Doug Warne dated September 15, 1981, he optimistically predicts that by Fall 1982 the Department would be offering a minimum of 4 graduate courses and an undergraduate course in the project/construction management area.

Although his predictions in the short term were not correct, Mike Ward did have the correct vision for the long-term development of a project/construction management programme in Civil Engineering, a goal which he had discussed with Fumio Otsu as early as 1978. Now during the winter term of 1982 with 3 project management courses launched during the 1981-82 academic year, there was reason for optimism, despite the dark clouds appearing on the economic horizon of Alberta. It was time to look at that long-term goal. In a Departmental meeting of Feb. 15, 1982 specifically called for a discussion of the Department's 10 year development plan, Bob Loov suggested that at least 2 new full-time appointments are needed in the construction management area. Knowing the overall budget climate within the institution and the forecasts for the future, the Chairman continued to represent the view that outside funding should be sought for a programme and the establishment of a chair in this field. Furthermore, he felt that if such fund-raising were successful it would likely result in *matching grants* from the Government in late May or early June, he contacted Fumio Otsu regarding the project management programme. In response to which Mr. Otsu sent an outline of a complete graduate programme on project management. During the third week in September Dr. Ward accompanied by Drs. B.R. Gamble and J.F. Morrall, met with representatives of Fluor Canada Ltd. to discuss means and ways of obtaining industry support which would allow establishment of a con-

struction/project management programme in Civil Engineering. Mike Ward reported this discussion at the Departmental Council Meeting on Sept. 30, 1982 stating that Fluor Canada Ltd. had supported the Department's suggestions and had agreed to establish an industry committee which would review the Department's proposals and make recommendations concerning the proposed programme. With the economy going from boom to bust during the first half of 1982 finding the necessary resources from industry became an even greater challenge. In his annual report Mike Ward summarized the Department's accomplishments during 1982 by stating that a proposal for development of a construction management graduate programme involving Fluor Canada Ltd. and Dr. Sam G. Mattar from the Alberta Department of Public Works had been partially completed.

As for actual course offerings during 1982-83, Dr. Ward's expectations from a year earlier did not materialize. The Fall of 1982 saw a single course offered by G.M.A. Ferrara (ENGG 505) while during the Winter '83 term, Doug Warne repeated the *Construction/Project Planning and Scheduling* course (see Table F 1).

To close out this section we note that starting in January 1984, Doug Warne was offering ENGG 505 in the winter terms for 4 successive years until 1987. With the exception of Winter '86 when he shared the lecturing with Dr. Michele A. Sargious, he was looking after the course completely. It is noteworthy that after its introduction in the Fall of 1981, ENGG 505 replaced the *Operations Research* course, ENGG 503, which was discontinued effective 1982. The *Cost Engineering* course was cancelled in the Winter '88 term and was removed from the calendar thereafter.

The Project Management Innovative Project, PMIP

By year's end in 1982 the Department's hopes to develop the Fluor course offerings into a full-fledged graduate programme were fading rapidly. Establishment of such a programme based on industry support alone, had become an unrealistic expectation in view of the deteriorating economic climate. New input and a fresh approach was clearly needed in order to maintain the project management momentum and to have a reasonable chance at success. The required additional impetus came from the local chapter of PMI, its Board and a few of its members. They had been looking for opportunities to help initiate and support university level courses and programmes in project management. To this end a working group of the Chapter approached the Department during 1982.

The initial contact was further developed late in the year when Dr. S.G. Sam Mattar, Project Manager, Alberta Public Works, Supply & Services, Calgary, met with the Department Head, as stated in Dr. Ward's annual report. Their discussions were continued at weekly luncheon meetings during most of January 1983 at which details of possible course offerings and the type of support to be expected from members of the Chapter were clarified. In February and March, Messrs. Leonard H. Pakuljak, Vice-President of the Southern Alberta Chapter of PMI and Manager of Esso Resources Ltd.'s Cold Lake megaproject, and Warren E. Allen, President of W.E. Allen & Associates, were drawn into the deliberations. As Mike Ward reported to his colleagues at the Departmental Council Meeting on April 7, 1983, Warren Allen and Sam Mattar had developed a complete outline for a course, *Intro to the Project Management Process*, which they were interested in offering at The U of C at an early date.

Table F 1 INITIAL PROJECT MANAGEMENT COURSE OFFERINGS

| Year | Term | Course Number | Course Title | Instructor | Company | Enrollment |
|------|------|---------------|-------------------------------|-----------------|---------------------|------------|
| 1980 | W | ENCI 501 | Civil Engineering Projects | Fumio Otsu | Fluor Canada Ltd. | 53 |
| | F | ENCI 619.86 | Applied Cost Engineering | G.M.A. Ferrara | Fluor Canada Ltd. | 20 |
| 1981 | W | ENCI 619.89 | Project Planning & Scheduling | G.M.A. Ferrara | Fluor Canada Ltd. | 18 |
| | F | ENGG 505 | Intro to Cost Engineering | D.A.W. Williams | Fluor Canada Ltd. | 31 |
| | F | ENCI 619.92 | Project Management | D.J. Parker | Fluor Canada Ltd. | 10 |
| 1982 | W | ENCI 619.93 | Project Planning & Scheduling | D.J. Warne | Parter Lavalin Inc. | 21 |
| | F | ENGG 505 | Intro to Cost Engineering | G.M.A. Ferrara | Fluor Canada Ltd. | 20 |
| 1983 | W | ENCI 619.93 | Project Planning & Scheduling | D.J. Warne | Parter Lavalin Inc. | 24 |
| | F | ENGG 505 | Intro to Cost Engineering | D.J. Warne | Parter Lavalin Inc. | 30 |
| 1984 | W | ENGG 505 | Intro to Cost Engineering | D.J. Warne | Parter Lavalin Inc. | 48 |
| 1985 | W | ENGG 505 | Intro to Cost Engineering | D.J. Warne | Parter Lavalin Inc. | 48 |
| 1986 | W | ENGG 505 | Intro to Cost Engineering | M.A. Sargious | Parter Lavalin Inc. | 48 |
| 1987 | W | ENGG 505 | Intro to Cost Engineering | M.A. Sargious | Parter Lavalin Inc. | 2 |

A three page letter with attachment, dated June 4, 1982 from Fumio Otsu, Fluor Engineers and Constructors, Inc., Southern California Division, Irvine, California, to Michael A. Ward, PhD: Subject: University of Calgary Construction Management Programme

The Head went on to report that there seemed to be a great deal of interest in the profession for his type of course and that industry support might be forthcoming if it were included in our graduate offerings. The Institute is planning to develop 6-8 courses aimed at a Dipl or MEng programme, which might qualify for funding from the Department of Advanced Education, DAE.

In fact, Mike Ward had received a document entitled *A Graduate Level Project Management Course* dated March 23, 1983 which described details of the Allen/Mattar course. Warren Allen, who spearheaded the course/programme development aspects of the local chapter, was representing the viewpoint from the outset that what was needed was not a single course but a package of courses, constituting a complete graduate programme. He worked out the overall framework of such a programme, including seven core courses in project management, details of which were established subsequently with the help of others. Mr. Allen was well qualified to undertake such course and programme development since prior to moving to Calgary in Oct. 1979 he had designed and taught a project management course at the University of Toronto.

The proposed plan for a Master's programme was delivered to the Department prior to a meeting on May 10, 1983, at which Warren Allen, Sam Mattar, Len Pakulak and Mike Ward finalized arrangements for the offering of the Allen/Mattar course in Sept. 1983, arrangements and commitments which were stated in a letter from Len Pakulak to Mike Ward, dated April 27, 1983. The proposal for a complete graduate programme, including a position paper entitled *Project Management: Options in Education* by S.G. Mattar was also discussed. With all its unique and innovative features, Dr. Ward felt that his programme proposal might qualify for support from DAE's *Innovative Projects Fund*.

In order to ensure compatibility with Advanced Education's guidelines and to try to accelerate the approval process, Warren Allen, with the agreement of the Department Head, consulted the staff in DAE in early April, showing them a draft of his programme proposal, including tentative budget figures and suggested contributions from industry. The U of C and DAE.

Realizing that the success of their application for programme approval and funding from DAE's Innovative Projects Fund will hinge to a large degree on the support from industry and the need for such a programme, the Group decided during their deliberations that a University-Industry Advisory Committee is essential. To this end senior executives in a wide cross section of the local business community were invited to become members of the Project Management Advisory Committee, PMAC. One of these executives was Mr. R.H. (Dick) Shaw, Vice President, Development, Shell Canada Resources Ltd., who was brought into the planning process at a luncheon meeting on June 6, 1983 at which Messrs. Allen and Ward reviewed the events of the preceding 5 months and where a strategy for the formation and the inaugural meeting of the PMAC, as well as the programme proposal were

The first meeting of the Advisory Committee was held on Wednesday, July 6, 1983 in Room F231 of the Civil Engineering Building, under the chairmanship of Warren Allen, with 19 members attending. Len Pakulak was recording secretary for the meeting. The draft proposal for the Master's Programme was briefly reviewed by the Chairman. During the discussion a number of improvements were suggested and the opinion was voiced that the programme should be a joint undertaking between the Faculties of Engineering, Management and Environmental Design. Mike Ward outlined the development of project construction management related course offer-

ings in Engineering and described how the proposed programme could be accessed by both MEng and MBA Master of Business Administration candidates. He also outlined the approval process for such programme initiatives within the institution and with DAE, specially noting the possibilities with the Innovative Projects Fund. The terms of reference of the PMAC were reviewed and approved by those present. The Chairman then reviewed the status of the *Fundamentals of Project Management* course (the Allen/Mattar course) which was scheduled for September. In addition to himself and Dr. Mattar, 10 guest lecturers and 14 other participants/project sponsors from industry had committed themselves and/or their organization to be involved in and to contribute to this course. As a last item of business, Messrs. Allen, Mattar, Pakulak and Ward were asked to develop an industry-based market survey brief for the determination of existing need for the proposed programme. The Committee was to report at the next meeting of PMAC on Oct. 5, 1983.

Soon after the inaugural meeting of PMAC, Messrs. Dick Shaw, Mike Ward and Warren Allen agreed to serve as first Chairman, vice Chairman and Secretary of the Committee, respectively. Mike Ward was left with the task of remodeling Warren Allen's draft proposal, appropriately modified by inputs from the University and PMAC and adapting it to University and DAE format and procedure specifications and guidelines. He was also left with the responsibility of shepherding it through the university's approval process, involving Graduate Faculty Council, the President's Executive Advisory Committee PEAC, the Institutional Policy and Priorities Committee IPPC, 4 Deans and the V.P. (Academic). Finally on Nov. 16, 1983, the *Letter of Intent-Innovative Projects: An Experiment in the Delivery of Postgraduate Project Management Coursework*, prepared by The U of C with support from the Project Management Institute, Calgary, Esso Resources Ltd., Calgary and other private sector companies, was mailed by the Vice President (Academic) to Dr. D.E. Berghofer, Assistant Deputy Minister, DAE. During the next month, Messrs. Allen, Shaw and Ward met several times to develop a strategy for defending the proposal at a meeting with DAE scheduled for Friday, Dec. 16, 1983 at the Petroleum Club in Edmonton, where this Calgary contingent was apparently successful in convincing the Assistant Deputy Minister and his Director of Programme Planning and Development, Dr. Brent W. Pickard, of the need for such a programme and the merits of the proposal. It still took over 7 months, till July 31, 1984, before final, definitive notification of programme and funding approval was received from Dr. Berghofer, even though unofficially Mike Ward had heard of the success of his application, which prompted an announcement at the May 4th Departmental Meeting.

The letter from the Assistant Deputy Minister defines the purpose of the project as the development and implementation of a series of 7 post-graduate Project Management courses for engineers and architects, to be phased in over a 3 year period, starting July 1984. Recognizing that the start-up phase of the project had already been successfully completed during 1983-84, the grant of \$175,000, was to be used during a 3 year period, July 1, 1984 - June 30, 1987, with contributions from industry and the university, bringing total programme costs for that period to \$310,000. Dr. Berghofer, on behalf of DAE, acknowledged the close cooperation between the university and the private sector in the development of this Innovative Project. Almost immediately after receipt of written approval for the programme and its funding, Dr. Robert E. Loov, the new Head, appointed Mr. Warren E. Allen as Adjunct Professor and Director of the Project Management Innovative Project, PMIP, effective July 1, 1984.

The PMIP was thus officially established, with its Director and with funding secured for 3 years.

The Project Management Programme and its implementation

The Project Management Programme, PMP, as it was introduced in the PMIP and as it continues today was the brainchild of Mr. Warren E. Allen. It was a 3 year experiment designed to test the viability of new innovative concepts and methods in the presentation of graduate level courses in Project Management. It was unique in a number of ways:

- the overall programme structure and detailed course outlines were planned, primarily by professionals outside the university
- the programme, as implemented, was not available anywhere else in Western Canada
- the programme was supported by three major faculties within the institution, namely the Faculties of Engineering, Management and Environmental Design, Architecture
- the programme delivery was designed to have strong participation from industry executives, business managers and project management practitioners, as instructors and special lecturers
- a strong practical orientation was built into the programme so as to expose the student to the subtleties of actual project environments
- the programme was specifically aimed at the working engineer or architect with more than 5 years of practical experience after graduation

The mode of presentation thus normally demanded a lead instructor or course coordinator with a large number (10-20) of guest lecturers and special/support instructors. The programme was conceived to consist of 10-14 graduate level courses which would be accessible by candidates in the Master of Engineering, MEng, Master of Business Administration, MBA, and Master of Environmental Design, Architecture, MEVDS programmes. Seven (7) of the courses formed the basis or core of the programme (see Table F 2). In addition, between 3-7 elective courses were to be designed and offered as demand and available resources dictate. To date, only one such additional course was introduced in the Fall of 1991.

Implementation of the programme was to take place over a period of 3 years, with only 1 course being offered during the first year, 3 courses during the second and all 7 courses in the 3rd year of operation. Since the basic course, *Fundamentals of Project Management*, was offered during 1983-84, before the PMIP was in place, the whole programme was implemented by June 30, 1986 (see Table F 2). The course offerings during the Winter '86 term could have been in jeopardy due to Warren Allen's sudden resignation and departure at the end of December 1985. The resulting extra teaching load was shouldered by Drs. A.E. McMullen and J.F. Morrall, the former becoming course coordinator for ENCI 619 57 while the latter helping out in ENCI 619 56 until a replacement lead instructor/course coordinator could be found. In addition, Rod de Paiva agreed to cut short his sabbatical leave, return to full duty and take on the Director's responsibilities in March, a position to which he was appointed on July 1, 1986. Dr. de Paiva had spent 6 months of his leave in the Burnaby office of JMA Spantec Ltd., immersing himself in their project management atmosphere. The implementation of the programme together with names of instructors, total number of industry participants per course and course enrollments are summarized in Table F 2 for the period 1983-86.

The Project Management Specialization PMS

When Dr. H.A.R. de Paiva was appointed Director of the PMIP, the future of the project and programme was rather uncertain. Funding was guaranteed only for a further 12 months from the DAE Innovative Projects Fund. The Faculty of Management wanted to have the programme housed in their faculty while Civil Engineering had decided only weeks earlier that the Project Management Programme should be established as a specialization within the regular MEng programme, be administered by a Director and continue to be located in the Department.

Within a few weeks of taking office, Rod de Paiva put together a final version of a Project Management Programme proposal which would provide specialization within the MEng and MBA programmes in their respective faculties. The administration of the programme and its Director would be housed and be under the auspices of Civil Engineering. He also prepared a request for extension of funding from DAE's Innovative Projects Fund (IPF), 'until such time as a new programme proposal for a graduate programme in Project Management can be prepared, submitted and considered'. The submission, which was mailed to DAE on July 31, 1986, requested \$225,000 over a 2 year period, 1987-89. A response was received on Sept. 11 informing the V.P. (Academic) that the PMIP no longer fits within the guidelines of the IPF. Also, since Project Management was not included in the university's list of proposed new programmes it could not be considered for such funding. Dr. Bierghofer went on to state that PMIP was funded on the understanding that if the programme proved stable and viable at the end of 3 years it would be financed by industry and the university.

It was thus clear that the project management programme would survive only if the Faculties of Engineering and Management commit themselves, both academically and financially to a continuation of this specialization. To this end, the Director presented his so-called 3 scenarios

for operation of the programme at the Departmental Meeting on Oct. 27, 1986, all of which involved commitments from both faculties and the institution. After much negotiation during the Fall, Rod de Paiva succeeded in having the two faculties and the university reach an agreement on joint responsibility and joint funding of the Project Management Specialization PMS. According to his agreement, each faculty would be responsible for half the course load, i.e. 3 courses each, and have joint responsibility for the 7th course, Fundamentals of Project Management, in addition to looking after its own courses. Management will contribute \$8,500 annually to Engineering in support of the administration of the PMS. The university committed itself to an annual expense of \$25,000 for the support of PMS, roughly the estimated value of fees received. Engineering is to provide 1.2 FTE academic and 0.4 FTE secretarial staff plus supplies and services for its courses, with the administration of the programme and the Director to remain in Civil Engineering. The two faculties and the university were to join with the Project Management Advisory Committee, PMAC, in a fund raising campaign, to be initiated as soon as possible for the support of the PMS and the establishment of a Chair. The agreement and associated financial commitments to become effective with the 1987-88 academic year. Thus the future of the PMS was placed on a firm foundation.

To complete the integration of the PMIP into the existing graduate programmes in the two faculties, the 7 courses were assigned new permanent course numbers and approved by the various councils (see Table F.2).

With the PMS thus securely in place, the Director turned his attention to an undergraduate course in this specialization. At the departmental meeting of April 2, 1987, Dr. de Paiva noted that ENGG 505

Intro. to Cost Engineering will not be offered after the Winter '87 term. He informed his colleagues that he had been examining the course contents of ENGG 505 and ENME 541 *Project and Production Engineering*, in order to respond to a suggestion that Civil Engineering reintroduce

an undergraduate course in project/construction management. During the summer, Rod de Paiva completed his development of a course, ENCI 571

Engineering and Construction Management, which was presented to the Departmental Council on Sept. 11, 1987. It was approved by all relevant councils and was introduced as a 4th year optional course by Rod de Paiva in the Winter '89 term with 46 registrants.

During the last 3 years of his term as Director, Dr. de Paiva concentrated on developing and having approved a joint Diploma programme between the Faculties of Engineering and Management. This programme was approved in 1990 with its first graduates, Messrs. A.G. Howton and T.C. Huang, receiving their degrees at the Fall '90 Convocation. At the same ceremonies on Nov. 9, the first MEng degree from the Project Management Specialization was granted to Mr. J.E. Curren.

Effective July 1, 1991, Prof. Francis T. Hartman is the Director of the PMS. The programme continues to grow and develop with support from industry, in terms of providing lecturers and instructors, continuing undiminished. Major donations by Shell Canada Ltd., Delta Catalytic Corp. and Gulf Canada Resources Ltd. during the spring of 1992 were earmarked for the establishment of a chair in Project Management, which became a reality soon thereafter.

Prior to handing over the reins, Rod de Paiva designed and had approved an additional PM course, ENCI 619.80 *Law for Project Managers*, a course which was offered for the first time during the Fall '91 session.

The PMS is one of the most successful, truly interdisciplinary programme development at The U of C, brought about by close cooperation between the business community and segments of the institution. The manner in which it was launched during a period of governmental and institutional fiscal restraint underlines the resourcefulness, negotiating skills and foresight of its champion, Dr. Michael A. Ward.

Table F.2 PROJECT MANAGEMENT COURSE IMPLEMENTATION AND STATISTICS 1983-1988

| Course Number
(Old/New) | Course Title | 1983-84 | | | 1984-85 | | | 1985-86 | | | 1986-87 | | | 1987-88 | | |
|-----------------------------------|--|------------------------------------|-------|----|-----------------------|-------|----|--------------------------------------|-------|-----|----------------------------|---------|----|----------------------------|---------|----|
| | | Instructor | A | B | Instructor | A | B | Instructor | A | B | Instructor | A | B | Instructor | A | B |
| ENCI 619.42
(ENCI
POEN 691) | Fundamentals of Project Management | W.E. Allen &
S.G. Mattar
(F) | 40/35 | 26 | W.E. Allen
(F & W) | 79/74 | 25 | W.E. Allen (F)
S.G. Mattar
(W) | 73/65 | 7 | H.A.R. de Paiva
(F & W) | 44/37 | 8 | H.A.R. de Paiva
(F & W) | 45/41 | 12 |
| ENCI 619.49
(ENCI 697) | Project Planning and Control | — | — | — | W.E. Allen
(W) | 35/28 | 15 | W.E. Allen
(F) | 25/20 | 13 | H.A.R. de Paiva
(F) | 25/18 | 7 | J. McNeill
(F) | 18/15 | 11 |
| ENCI 619.50
(MOHR 691) | Project Human Resources and Organizational Effectiveness | — | — | — | R.D. Hardisty
(W) | 27/26 | 10 | W.E. Allen
(F) | 6/15 | 5 | T. Golbeck
(F) | 12/11 | 4 | T. Golbeck
(F) | 15/15 | 5 |
| ENCI 619.54
(POEN 719) | Project External Issues | — | — | — | — | — | — | W.E. Allen
(F) | 11/10 | 6 | R. Cooke
(W) | 10/8 | 9 | H.B. Dingle
(W) | 14/14 | 9 |
| ENCI 619.55
(ENCI 693) | Project Engineering Management | — | — | — | — | — | — | T.F. Scott
(W) | 26/20 | 14 | P. Lovell
(W) | 16/16 | 8 | P. Lovell
(W) | 12/11 | 5 |
| ENCI 619.56
(OPMA 719) | Project Procurement and Logistics | — | — | — | — | — | — | L.L. Ash &
J.F. Morrill
(W) | 9/9 | 10 | — | — | — | D. Waters
(W) | 13/11 | 7 |
| ENCI 619.57
(ENCI 695) | Project Construction Management | — | — | — | — | — | — | M. Nelson &
A.E. McMillan
(W) | 16/13 | 11 | R. McTague
(W) | 18/16 | 8 | R. McTague
(W) | 27/24 | 10 |
| SUB-TOTALS | | N.A. | 40/35 | 26 | N.A. | 41/28 | 50 | N.A. | 75/65 | 75 | N.A. | 125/106 | 54 | N.A. | 144/131 | 59 |
| PMIP
Advisory
Committee | | N.A. | N.A. | 26 | N.A. | N.A. | 31 | N.A. | N.A. | 36 | N.A. | N.A. | 30 | N.A. | N.A. | 34 |
| TOTALS | | N.A. | 40/35 | 52 | N.A. | 41/28 | 81 | N.A. | 75/65 | 111 | N.A. | 125/106 | 84 | N.A. | 144/131 | 93 |

A = Enrollment Pass; B = No. of Industry Participants. MOHR = Management of Organizations and Human Resources; OPMA = Operations Management; POEN = Policy and Environment.

APPENDIX G

DEVELOPMENT OF COMPUTER ENGINEERING AT THE U OF C

On July 1, 1977 Dr. L.T. (Len) Bruton became Head of the Electrical Engineering Department. Only 3 weeks earlier at the Spring Convocation on June 10, 1977 the outgoing Head, Fred Trofimenkoff, was proud to see his Department be the leader amongst all Engineering Departments with the highest number of graduate degree recipients, including 3 PhD graduates. Unfortunately, it was the number of BSc graduates in Electrical Engineering which not only was the lowest of any department in Engineering but had hit a new all-time low for the Department with only 14 students receiving their degrees. In comparison Chemical, Civil and Mechanical Engineering awarded 24, 32 and 30 Baccalaureate degrees. It was the continuing low undergraduate enrollment which had become a problem of some concern during the second half of the *Trofimenkoff Decade*. Programme changes were introduced to remedy the situation but proved ineffective. Try as they would they were simply not able to come up with a solution which would rectify this problem of low undergraduate enrollment.

The new Department Head, Len Bruton, made it his mandate to try to reverse this trend. He was determined to take the Department out of the *trailing position* with regard to undergraduate enrollment. There were a number of complex reasons why Electrical Engineering undergraduate student numbers were low and stayed low during the 1970's. Clearly, the demand for graduates from Electrical Engineering was a factor, a variable which was closely tied to the fortunes of the oil and gas industry. There was, however, an additional, perhaps more significant reason in the departmental annual report written in late Summer of 1977. Len Bruton summed up the problem of low enrollment in Electrical Engineering as follows: "The number of students enrolled in our final year was disappointingly low. This was perhaps partly due to the rather poor academic performance of this particular class but, of course, it is also quite possible that there may have been something lacking in the content or motivational level of our programme."

As candidate for the Headship in Electrical Engineering, Dr. Bruton had stated that if appointed he would try to introduce, at the earliest possible date, a Computer Engineering programme. He felt that such a programme was not only timely but would likely increase the enrollment in Electrical/Computer Engineering substantially over existing levels. He made the suggestion knowing full well that there had been, and continued to be an increasing interest in and demand for background and education related to digital computers and computing. Departments of Mathematics across the continent were giving birth to Divisions or Departments of Com-

puter Science, while Electrical Engineering Departments were spawning Divisions or Departments of Computer Engineering. The University of Western Ontario was one of the first to establish a Department of Computer Engineering in this country.

The oil and gas industry, with its exploration activities, was particularly interested in and was a fertile ground for digital computing methods and their application to the analysis, filtering and enhancement of seismic signals. They were looking for some Computer Engineering background during job interviews with fourth year students. To meet the interests and demands of students and employers, the Department reviewed its third and fourth year programme offerings during 1975-76 and decided to add a course on *Logic Design in Engineering Systems* to its third year and a course on *Discrete Signal Processing* to its fourth year curriculum, thereby strengthening the Computer Engineering content of its undergraduate programme. New laboratory experiments were designed for these two new courses using special purpose microprocessor stations with specifically developed software. However, these measures had little impact on the undergraduate enrollment.

Soon after his appointment Len Bruton set about to implement his suggestion for establishing a Computer Engineering programme at The University of Calgary. It was clear that the computer software expertise residing in the Department of Computer Science was a factor which must be considered and possibly used in achieving the desired goal. Contacts with that department were established during the Summer of 1977. At the first departmental meeting chaired by Dr. Bruton, (August 25, 1977) after some discussion, the Department decided to

- expand its activities in the general field of Computer Engineering; and
- instruct its Curriculum Committee to consider and report on the method of implementing a Computer Engineering programme within the Department of Electrical Engineering.

With these decisions to back him, Len Bruton initiated discussions with the Head of the Department of Computer Science, Dr. A.W. Colijn. By mid-November agreement had been reached between the two Heads on a draft document outlining possible schemes for cooperation in the development of an undergraduate programme in Computer Engineering.

On December 12, 1977 Dr. Colijn was invited to a meeting of the Department of Electrical Engineering to discuss the Electrical Engineering/Computer Science cooperative programme in Computer Engineering. The Chair-

man, Dr. Bruton, outlined three options open to the Department, namely:

- To maintain the status quo with a number of elective courses for senior students some of which deal with computer engineering topics.
- To add 2-4 Computer Science courses to the list of electives for Electrical Engineering undergraduates.
- To design a complete programme package for Computer Engineering.

Dr. Colijn briefly reviewed the document of agreement between the two Departments which listed the courses or course packages which were available in Computer Science for Electrical Engineering students and reciprocally the courses which students from Computer Science could take in Electrical Engineering.

After discussing the three options, the Department decided to ask its Curriculum Committee to investigate and report back on option no. 2, namely to add 2-4 Computer Science courses to the list of Electrical Engineering electives.

The Committee reported back on February 9, 1978, recommending option no. 2. Detailed course outlines for 4 courses were to be obtained at the earliest possible date so that their content could be studied and if required, modifications recommended. The Committee also recommended to continue to plan for and work towards a Minor in Computer Engineering and to consider the addition of Computer Science courses to their list of optional courses as an exercise in *testing the waters* with respect to the popularity of and demand for a programme in Computer Engineering. Some members of the Department were namely of the opinion that if anything is put forward, it should be a proposal for an accreditable BSc programme in Computer Engineering with the ultimate goal of a separate Computer Engineering Department. The route Civil Engineering had elected in connection with the Surveying Engineering programme proposal.

At the April 17, 1978 departmental meeting, the Head reported that cooperation with Computer Science was disappointingly slow. The detailed course outlines which had been requested in December had not yet been received.

During the Spring of 1978 the Department decided to get some opinion and feedback from the third and fourth year Electrical Engineering students concerning preference for a Minor in Computer Engineering versus the standard Electrical Engineering programme. A poll was conducted which revealed that 82% of the third year and 70% of the fourth year class would have opted

either *definitely or probably* for the Minor had such a programme been available. At the June 16, 1978 departmental meeting, the Head reported these results. He also informed his colleagues that the Department of Computer Science has shown very little cooperation in producing a joint programme in Computer Engineering and that he had been unable to obtain the detailed course outlines which were requested in December. After some discussion it was decided (motion by F.N. Trofimenkoff and G.S. Hope) that 'the Department of Electrical Engineering proceed to develop a new professionally accreditable programme entitled a *Minor in Computer Engineering*. An amendment to the motion instructed the Departmental Curriculum Committee to work out the details for such a programme. The motion was passed unanimously.

It seems that news of the fact that Electrical Engineering was prepared to go *it alone* got some quick reaction from Computer Science since the detailed course outlines, which had been requested 6 months earlier, suddenly became available. Meetings between the two departments were resumed. It was months later, in February 1979, when a preliminary report on the Minor was finally available and was approved by the Department of Electrical Engineering. The Minor was to contain 5 new courses 3 of which were to be offered by Computer Science. In addition, students registered in the Minor would also take the four courses: ENGG 327, ENGG 407, ENEL 411 and ENEL 511, courses which are part of the Electrical Engineering programme. The final proposal for a Minor in Computer Engineering was presented to the Department on April 2, 1979 and was approved except for requesting additional details regarding required resources for implementation of the programme. On May 24, 1979, the proposal was brought back to the Department this time outlining in detail additional FTE's and funding required.

At the May 31, 1979 EFC meeting, Len Bruton moved that Council approve the development of a Minor in Computer Engineering programme in the Department of Electrical Engineering, to be implemented in the 1980-81 academic year subject to the necessary resources becoming available. In speaking to the motion, he noted that the Department of Computer Science had formally endorsed the proposal and was prepared to offer 3 half courses for students enrolled in the Minor in Computer Engineering. He also noted that implementation of the Minor would require 2.5 FTE's of which 1.5 would go to Computer Science and 1.0 to Electrical Engineering. He pointed out that the Department of Electrical Engineering at the University of Alberta had been working for the past year on a BSc programme in Computer Engineering which was to be a new degree programme for accreditation by the Accredited Board of the Canadian Council of Professional Engineers (CCPE). He expressed his belief that under the existing tight university financing, the proposal for a Minor was the appropriate action and was the more likely achievable goal as opposed to proposing a full fledged BSc pro-

gramme in Computer Engineering, and a Department of Computer Engineering with associated very significant requirements for additional manpower and physical facilities. The motion was approved.

At the September 20, 1979 EFC meeting, Dr Bruton reported that there may be a problem with the Minor in Computer Engineering since the Academic Review Committee of the Faculty of Science had not yet approved the proposal.

Despite this apparent *slow-down*, Len Bruton submitted at the October 5, 1979 EFC meeting his Department's calendar changes, including the new courses for the Minor in Computer Engineering which were approved by EFC. When the Policy and Planning Committee, PPC, discussed the Minor at its meeting on November 29, 1979, it decided that implementation of the programme would require 3 FTE's plus \$250,000 capital expenditure for computer equipment and that in view of such expenditures, the Minor may not be implementable. The calendar changes, which had been approved by EFC, were delayed. A letter from the Chairman of PPC dated January 10, 1980, requested additional information from the Department Head concerning projected enrolments for the Minor, associated increases in undergraduate enrolment in Engineering, together with additional space, staff and computer equipment requirements. Dr Bruton prepared a detailed response to the Vice President (Academic) and Chairman of PPC.

With this information, PPC approved the Minor in Computer Engineering in April of 1980 and soon thereafter, so did GFC. Its implementation was now subject only to availability of funds and final approval by the Board of Governors. The delay caused by PPC however meant that the earliest possible date for implementation was September 1981 instead of the Fall of 1980.

Good news came a long time later. In the Spring of 1980 when the Department was given a special capital allocation in the amount of \$225,000 for computer equipment which gave it a *head start* in planning and establishing facilities for the Minor in Computer Engineering. Through the Summer and Fall of 1980, rumours were abound. The Board had not taken any action on the Minor and according to *informed* sources the Deputy Minister was placing the Minor *on hold* making its implementation in September 1981.

On February 19, 1981, Dr Malik, the Acting Dean of the Faculty of Engineering, received a call from the Vice President (Academic) informing him that the Board of Governors had approved the Minor in Computer Engineering, effective September 1981. Dr Stein reported at the departmental meeting on February 25, 1981 that not only had the Board approved the Minor but, unofficially, funding had also been approved with the amount requested for the programme development grant having been increased to allow for inflation.

During the Spring of 1981 the Department of Advanced Education and Manpower (DAEM), and the Minister announced approval of the Minor in Computer Engineering at The U of C and funding for that programme in the form of a 4 year special programme development grant, the first installment of which for fiscal 1981-82 was \$130,000. The grant was based on a projected initial enrollment of 20 students which was to be increased to 40 over a 3 year period. The Department also received a \$350,000 capital equipment grant for the purchase and installation of a VAX-11/780 computer including facilities for an undergraduate terminal room with 20 workstations and peripheral equipment for instruction in computer graphics.

News of the approval and imminent implementation of the Minor in Computer Engineering spread quickly through the second year undergraduate student population so that by mid-April some 54 students had indicated their desire to register for the new programme. Consequently the Department at its meeting on April 15, 1981, decided to increase the enrollment limit for the Minor from 20 to 30 students.

Soon thereafter, Len Bruton decided to resign as Department Head for personal reasons. It was he who spearheaded the drive for establishing a Computer Engineering Minor in the Department of Electrical Engineering, a programme which surpassed even the most optimistic projections for its success. Continued growth in enrollment in the Minor and in Electrical Engineering during the decade following its introduction is now history. Encouraged by the overwhelming initial success of the Minor, the Department reopened consideration of a fully accreditable BSc programme in Computer Engineering under the direction of its new Head, Dr Gordon S. Hope, who was appointed for the period December 1, 1981, to June 30, 1986. Already at the Departmental meeting on February 5, 1982, on a motion by Drs. Trofimenkoff and Haslett, it was decided to 'proceed with the development of a Computer Engineering Programme'. At the May 28, 1982 EFC meeting, Dr Hope's motion for the development of a BSc in Computer Engineering programme proposal was approved. It took till October 1983 before the proposal had been endorsed by the various institutional committees, including the Curriculum and Academic Review Committee of GFC, CARG, and PPC. Only in June 1985 did GFC finally give its approval. The proposal is one of many awaiting funding approval by Advanced Education and the Government.

The Minor in Computer Engineering has been to date the most successful new programme development in the Faculty of Engineering. It changed the undergraduate student enrollment distribution across the departments and helped Electrical Engineering become the *front runner* in the Faculty in terms of total undergraduate student numbers. It served as the catalyst for the Department's explosive growth in many of its activities during the decade following its introduction.

APPENDIX H

EVOLUTION OF THE CIM MINOR AND THE MANUFACTURING ENGINEERING DIVISION AT THE U OF C

Introduction

As part of the first major revision of the new 1st and 2nd year common core engineering curriculum, initiated at the May 19, 1967 meeting of EFC and implemented in 1969-70 Mechanical Engineering was *fine-tuning* its departmental programme during 1968-69. A new course, *Production Operations Management*, was designed, likely on the initiative of Prof. W. Ernst Eder. When Prof. Allan A. Torvi was asked in the spring of 1970 to launch the new course, he decided to update and expand his background on the subject by attending the inaugural 2 week short course on Production/Operations Management at his alma mater the Univ. of Western Ontario, in June 1970. On his return, he told his colleague, Ernst Eder, about it who was so impressed that he enrolled in the revised and expanded (3 week version of the course, June 5-25, 1971.

As scheduled, Allan Torvi taught Engg 489 *Production Operations Management* to 15 registrants during 1970-71 thereby becoming the first engineering academic at The U of C to offer a management related course. Based on the positive response of the students, the Department decided during the year to move it into the senior year and make it one of the permanent electives. It was offered, again by Prof. Torvi during the following year as Engg 589, the designation under which it was listed for the first time in the 1971-72 calendar. When the Engg. course numbering system was discontinued in 1973, it became ENME 589 and as such continued as one of the electives until 1980-81 (see Table H-1).

With this background and experience, Profs. Eder and Torvi joined forces and launched a series of extension courses, offered through the Division of Continuing Education and inaugurated with a 3 day seminar on *Production/Operations Management*. This, the first extension course on management related topics offered by engineering academics at The U of C, was held at the Banff School of Fine Arts, June 1-3, 1972. The seminar was received enthusiastically by the profession so that it was repeated Dec. 6-8, 1972, Dec. 10-12, 1974, Feb. 18-20, 1976 and April 13-15, 1977. This very successful seminar series, discontinued after Ernst Eder's departure in June 1977, spawned other continuing education offerings, including a 2 day *Management for Engineers* course, presented in January, April and November 1975 in which Allan Torvi shared the lecturing with Dr. M. Blaine Lee from the Faculty of Business and Mr. J. Curt Longman of the Div. of Continuing Education. In the spring of 1979, April 26-27, Allan Torvi offered a 2 day short course, also organized by Continuing Education, on *Critical Path Methods CPM*, which was again so successful that it was repeated on Nov. 5-6, 1979, May 8-9 and Nov. 20-21, 1980, May 21-22 and Oct. 25 and 30, 1981, May 10-11, 1982, May 26-27, 1983 and December 1984.

Early Initiatives and Directions

The continuing demand for the type of extension course offered by Allan Torvi and others (see Appendix F) was an indicator of the need for university level programmes in specializations such as project and production engineering, project planning, scheduling and management, and cost engineering. The Department has had discussions, from time to time, concerning the feasibility

of introducing an industrial-production engineering programme. Lack of resources and space stymied any further action in the past. Early in 1979, the Dean raised the matter again after he had received several enquiries for such courses. In response, the Department at its meeting on Jan. 12, 1979, once again, considered the question and the staff and space requirements for such undertaking. On a motion by Prof. A.A. Torvi and W.E. White, Departmental Council established an Ad Hoc Committee to consider the feasibility, desirability and demand for an Industrial/Production Engineering programme. In addition to the

mover and seconder of the motion, the Committee also included Profs. J.A.C. Kentfield, D.H. Norrie and P.G. Glockner.

Some 8 months later, on Aug. 31, 1979, Departmental Council discussed the establishment of an *Engineering Design Unit* proposed by Dr. G. Walker in a memo dated July 31, 1979. Amongst other functions, Prof. Walker would have the Design Unit provide advanced educational opportunities in engineering design, including computer aided design and graphics, CAD/CAM. A working group consisting of Profs. Walker, Kentfield and

Table H-1 Manufacturing, Production and CIM Courses

| Year | Course Number | Course Title | Action/Comment |
|--------------|--|--|---|
| 1968-69 | Engg. 588* | Manufacturing & Production Processes | Intr. W '69 |
| 1969-70 | Engg. 488* | Manufacturing & Production Processes | Moved: 4th to 3rd year, W '70 |
| 1970-71 | Engg. 488
Engg. 489 | Manufacturing & Production Processes
Production Operations Management | Intr. F '70 |
| 1971-72 | Engg. 491
Engg. 589* | Manufacturing & Production Processes
Production Operations Management | Renumbered
Moved: 3rd to 4th year, W '72 |
| 1973-74 | ENME 589*
ENME 491 | Production Operations Management
Manufacturing & Production Processes | Renumbered
Renumbered |
| 1980-81 | ENME 589* | Production Operations Management | Del. |
| 1981-82 | ENME 539*
ENME 541* | Computer Aided Design
Project and Production Engineering | ntr.
ntr. |
| 1983-84 | ENME 543*
ENME 619.57 | Computer Aided Design & Manufacturing
Special Problems in Computer Aided Manufacture | ntr.
ntr. F '83 |
| | ENME 619.65 | Special Problems in Computer Aided Design | ntr. W '84 |
| 1984-85 | ENME 591
ENME 545*
ENME 547* | Manufacturing & Production Processes
Computer Control of Dynamic Systems
The Use of Finite Elements in CAD/CAM | Moved: 3rd to 4th year
ntr.
ntr. |
| 1986-87 | ENME 619.77
ENME 619.80 | Knowledge Based Systems
Principles & Applications
Problems in Manufacturing Techniques | ntr. F '86
ntr. W '87 |
| 1987-88 | ENME 619.83 | Object Oriented Programming | ntr. F '88 |
| 1988-89 | ENME 549*† | Elements of Robotic Engineering | ntr. |
| 1989-90 year | ENME 491 | Manufacturing & Production Processes | Moved: 4th to 3rd |
| | ENME 543*†
ENME 551*†
ENME 553*†
ENME 555*† | Computer Aided Design & Manufacturing
Computer Aided Design & Graphics
Computer Numerically Controlled Machining
Computer Integrated Manufacturing System | Del.
ntr.
Intr.
Intr. |
| 1990-93 | ENME 671
ENME 673 | Planning and Control of CIM
Discrete-Event Simulation of Manufacturing Systems | Intr.
Intr. |
| | ENME 679
ENME 619.77) | Advanced Manufacturing Technology | Renumbered/
Renamed |
| | ENME 681
ENME 619.57) | Mechanical Engineering Design Methodology | Renumbered/
Renamed |
| | ENME 695 | Artificial Intelligence Applications in Manufacturing | Renumbered/
Renamed |
| | ENME 619.93) | | |
| | ENME 697 | Intelligent Manufacturing Systems | Intr. |

* = Elective; † = Compulsory ntr = CIM Minor ntr = Introduced Del = Deleted

Torvi were asked to prepare an outline proposal for such a unit.

At the Jan. 29, 1980 meeting of the Department, Joe Walker reported on his earlier proposal. He informed his colleagues that the Drafting Department at the Southern Alberta Institute of Technology (SAIT) was ordering a state-of-the-art CAG System which he intended to visit with the 4th year class. He expressed the opinion that in view of the industrialization of the province, the curriculum should include courses on CAD and CAG and in computer aided manufacturing, CAM, and that a Faculty wide policy was needed on this matter. His suggestions were supported by Prof. Norrie who had seen such systems being used at Cambridge University and found them to be most impressive. He noted also that the staff of the newly created Division of Surveying Engineering are making extensive use of computers in their work where satellite positioning is applied. The discussion was concluded by 2 motions, both by Prof. Walker, suggesting that the engineering curriculum should include material on CAD/CAG and that a Faculty Committee be established to consider the matter.

The Dean was quick to respond and established a Committee which considered, among other items, a request from Electrical Engineering for a stand-alone computer. As was reported at the Departmental Council meeting on April 2, 1980, Mechanical Engineering was supporting this request in return for a graphics terminal to such a computer. Prof. Walker expressed the opinion that in 2-3 years time the Department will require its own computer to handle the graphics terminals in Mechanical Engineering, in fact within 6 months, at the departmental meeting on Sept. 19, 1980 the departmental computer coordinator, Dr. D.J. Malcolm proposed a stand-alone computer for the Department's computer graphics work.

Further momentum was provided to the Industrial/Production Engineering proposal by Prof. Walker in a memo dated Jan. 27, 1981, in which he suggested a *Department of Industrial Manufacturing and Production Engineering*, to be started within Mechanical Engineering at The U of C. Copies of his memo were sent to the Dean and Acting Dean of Engineering, Drs. T.H. Barton and O.P. Malik, the President Dr. N.E. Wagner, and the Premier The Hon. Peter Lougheed. As a result of this memo and the response from the V.P. (Academic) dated Feb. 10, 1981, the preparation of a Letter of Intent was proposed by Departmental Council on Feb. 23, 1981, and the establishment of a Committee for the task was approved even though during the discussion it was pointed out that there was no space at the moment for such a department.

A draft of the *Letter of Intent - BSc in Project and Production Engineering*, was distributed by the Committee, consisting of Profs. Walker, Torvi and Glockner, on March 9, 1981. It defined project and production engineering to include:

- Computer aided design, CAD, and graphics;
- Computer aided manufacturing, CAM;
- Micro-and mini-computer control of process;
- Robotics;
- Scheduling, contract administration;
- Engineering economics, cost control, estimating;
- Reliability and quality control.

The document foresaw staging for the development and implementation of the programme proposal with the required new Mechanical/Project &

Production Engineering Wing being completed by Fall '84. The Letter of Intent was approved by Departmental Council at its meeting on March 11, 1981, on a motion by G. Walker and A. Torvi, after which it was sent to the Acting Dean for discussion by the Dean's Advisory Council, DAC, and for transmittal to EFC. It was also discussed at the University/Industry Seminar, organized for the Department by Prof. G. Walker on April 14, 1981.

At the Departmental meeting of April 20, Drs. Walker and Pollard moved that the Letter of Intent be shelved for the time being, largely due to the limited resources available and the difficulties with staff. Three academics had resigned between Feb. 6 and March 10, 1981. The Head informed Dr. Malik of the Department's decision on the day of the meeting, April 20, 1981.

Despite this setback, activity in computer aided design and graphics continued to grow. For example, at the Sept. 15, 1981 meeting of the Department, the Acting Head, Dr. Doige, announced that \$120,000 had been set aside for Mechanical Engineering to obtain computer graphics equipment, with Drs. Doige, Mikulick, Norrie and Prof. Torvi being involved in selecting the appropriate products. By Feb. 3, 1982, Prof. Doige could inform the Department that a proposal for a Harris graphics computer facility has been sent for approval to the University's Computer Committee and that the Dean had requested a computer numerically controlled CNC, milling machine in the Faculty's capital budget, equipment which would also become available to the Department for instruction and research in computer integrated manufacturing, CIM.

At the meeting on Aug. 31, 1982, the Department was informed that Room B-205 had finally been assigned to Mechanical Engineering and would be used to house the Harris computer and graphics facility. With all this activity it was not surprising that the shelved proposal was dusted off, was reworked and under a new name, *Letter of Intent - BSc Computer Integrated Manufacturing, CIM*, was resubmitted to the Department at its meeting on Dec. 2, 1982. On a motion by Drs. D.H. Norrie and O.R. Fauvel, it was approved and was transmitted to the Dean for consideration by EFC and ultimately by DAEM.

The CIM cause was furthered also when during the Fall of 1982 Doug Norrie, the Department's computer coordinator after the departure of Drs. D.J. Malcolm and M.J. Bush, succeeded in negotiating an \$800,353 computer equipment donation from American Computers and Engineers Ltd for 12 *Cromenco Microcomputers*, with a matching grant from the Province.

On March 3, 1983, EFC approved the CIM Letter of Intent and it appeared that it was on its way to DAEM and that the go-ahead for the preparation of a Type A new programme proposal was imminent. Details of how its institutional approval and submission to Advanced Education were delayed are discussed briefly below.

The CIM Centre

One of the departmental and faculty highlights of 1983 was the official opening of the CIM Centre the two main components of which were the graphics facility in Mechanical Engineering and the CNC machining centre in the Faculty workshop. The event was scheduled for May 11, 1983 so as to coincide with the start of the *First Canadian Universities Conference on Computer Aided Design/Graphics/Manufacturing, CAD/CAG/CAM* May 12-13, hosted by the Department and organized by the CIM Group. Drs. Dost, Fauvel, Mikulick and Prof. Torvi spearheaded by Dr. Norrie. The opening for the \$0.75 million Harris graphics facility was scheduled for 3:00 p.m. in

Room B-205 and was symbolized by Dr. Brian S. Norford, Chancellor of The U of C, pushing a button on the minicomputer being assisted by Dean T.H. Barton and Mr. A.C. Milroy, Executive Director of A.A.A.A.

This state-of-the-art CIM facility consisted of a Harris 800B super-minicomputer, 2 CDC disk drives, a Harris tape drive, line printer and 16 alphanumeric terminals, various color and graphics terminals, printer/plotters and CAD/CAG/CAM software packages. The main hardware components were obtained through a donation from the Harris Corporation in Fort Lauderdale, Florida with a matching grant from the Province. Software and peripherals were also obtained through donations. The main donor of the facility was represented by Messrs. Roy French and Barry Zimmerman of their Computer Systems Division. After the dignitaries and members of the small crowd present were impressed by the 3-dimensional images spinning and tumbling across the screen of a sophisticated color terminal, the group moved downstairs to the Faculty workshop.

The Chancellor, Dr. Norford, also performed the official act of opening (again) by pressing a button, the \$175,000 computer numerically controlled, CNC Matsuura 760V 3 axis vertical machining centre which was hooked up to the Harris facility. The distinguished visitors and guests were each presented with an aluminum ashtray, fresh off the press, so to speak, machined during the opening ceremonies to demonstrate the centre's capabilities. The machine was ordered with a fourth axis capability, a feature which was added in 1984 at an additional cost of approximately \$10,000.

With these openings, the Faculty of Engineering and the Department became one of only a handful of centres with such CIM facilities, establishing Mechanical Engineering at The U of C as a leader in CAD/CAG/CAM. Most of the credit for this achievement must go to Dr. D.H. Norrie who spearheaded the CIM Group and was responsible for the negotiations which resulted in the equipment and software donations and matching.

Within a year, the Harris facility was operating at capacity so that a second Harris 800B mainframe was installed in late 1984. This additional equipment and the rapid growth in use of the facility in undergraduate and graduation education and research necessitated the conversion of a laboratory, Room B-203 into a computer terminal room. After the completion of the new Civil Engineering Wing, the V.P. (Services) was willing to release Room B-306 from his class-room inventory and assign it to the Department for use as an undergraduate Computer/Terminal Room. The Harris computers/system was replaced in 1987-88 by 3 SUN workstations to keep up with the increase in workload on the CIM system. Also, in 1989, the Faculty decided to transfer the CNC machining centre to Mechanical Engineering thereby facilitating its use in CAM course instruction and research.

The Space Problem

In his final major document for Faculty development, a *Proposal for Stage III Development of the Engineering Complex*, dated March 7, 1967, Dean A.M. Neville projected saturation of the Faculty's initial 1968 facilities before 1971, as compared with the planned date of 1972. The projection was based on a detailed study of the Faculty Planning Committee consisting of Drs. H. Andre and A.G. Doige and Prof. G.J. Berg with Dr. Douglas H. Ayde as chairman. The Committee's report dated Feb. 28, 1967, used the most recent undergraduate and graduate enrollments and research activities which had grown much more rapidly than originally expected, especially in Civil Engineering. The Dean, therefore, proposed extensions to the

Civil and Chemical Engineering Wings with occupancy for 1969 and 1971 respectively. The expanded facilities were estimated to meet the Faculty's space requirements until 1973-74 with further expansion, extensions to the Mechanical and Electrical Engineering Wings, proposed to be ready for about 1973.

The first departmental document discussing an extension to the Mechanical Engineering Wing was Planning Report No. 2 *The Future Development of the Department of Mechanical Engineering*, dated Nov. 1967. In it, its author Dr. D.H. Norrie suggested that on the basis of departmental enrollment growth and expansion in staff and research activity the Mechanical Engineering space is expected to be fully saturated by '970 and that an addition to the B-Wing be ready for occupancy no later than 1971-72. A subsequent *Proposal for Extension of the Mechanical Engineering Wing* was sent to the University's Academic Planning Committee, APC, on June 30 1969, by the Chairman of the Faculty's Planning Committee, Dr. M.F. Mohtadi, in which he proposed a 35,000 ASF, assignable square feet 3252 ASM addition to the 22 150 ASF (2058 ASM) existing B-Block.

A slow down in economic activity during 1969-70 reduced undergraduate enrollments compared with projections, resulting in postponement of the Civil and Chemical Engineering extensions (see Chapters I and IV and Appendices E and F). Funds for construction were progressively reduced until in 1975 a complete freeze on new capital projects was instituted by the Province. Plans for expansion were therefore shelved for the time being.

Ironically in the same year 1975, the Faculty experienced a dramatic increase in undergraduate enrollment with first year registration in September reaching 580 as compared with 324 on Dec. 1 of 1974. Total undergraduate student numbers grew to over 1000 from previous maxima of less than 700. Consequently during the next two years, the third year enrollments showed unusually high growth rates, particularly in Civil and Mechanical Engineering, with the latter recording a junior class size of 83 in Sept. '77. Coping with that many students stretched the Department's facilities to their limit. As discussed in Chapter VI, an auxiliary home room had to be created, using a laboratory. Extra staff was needed for whom there was no suitable office space.

In his departmental annual reports starting in 1976, the Head was emphasizing the critical space shortage and the need for an extension to the B-Wing. Figures provided by the Office of Institutional Analysis, OIA, and based on the University's space formula confirmed the Department's space problem to be the most critical in the Faculty.

In June 1979 the government announced the approval of the surveying engineering programme and the Civil Engineering extension. Suddenly it appeared that the freeze had been lifted and that there was a possibility for the Departments in the Faculty to have their plans for badly needed extensions become reality. It also seemed that the coupling of a strong, industry supported programme proposal with the request for additional space enhances the probability of approval for the project.

On Sept. 21, 1979, Doug Ruth and Allan Torvi initiated discussion at the departmental meeting on an extension to the Mechanical Engineering Wing. Council decided to establish an Ad-Hoc Building Committee consisting of Drs. Kentfield, Norrie, Ruth and White with Prof. Norrie as chairman and Mr. John Holdsworth, the Technical Supervisor serving as resource person. The Department's critical space shortage was on Council's agenda again, on May 28, 1980 when the Head informed

his colleagues that funds were made available for the creation of make-shift office space for graduate students and visitors. He went on to note that a proper report will have to be prepared as soon as possible to spell out the Department's space requirements and to explain the 100% shortfall in departmental laboratory and research space.

When Dr. Trevor Groves raised the matter of laboratory space shortage again on Sept. 29, 1980 the Chairman repeated his comments to Council concerning the urgency for a report detailing the Department's space shortfall and the need for an addition to B-Wing. After some discussion, Council decided to establish a Space Committee to study short and long term space needs, with Allan Torvi as chairman. In a memo, dated Dec. 12, 1980 Prof. Torvi asked for input for his Committee. He reported at the Jan. 18, 1981 meeting of Council that he had received no response. A second request for details on space requirements also remained unanswered according to his statement at the Department's meeting on Sept. 15, 1981. And yet, according to all indicators, this was the time for submitting expansion proposals. The New Civil Engineering Building was under construction and both Chemical and Electrical Engineering had proposed new programmes with appropriate extensions to their wings. According to the minutes of the Sept. 17, 1981 EFC meeting, the Dean stated that 'there is no better time than the present to plan for expansion'. The government and the profession were apparently of the same opinion as indicated by discussions at a meeting on Friday, Dec. 4, 1981 in Edmonton, called at the initiative of APEGGA by Dr. Henry Kolesar, Deputy Minister of the Department of Advanced Education and Manpower, DAEM. The meeting, at which Engineering Deans and Academic Vice-Presidents from the U. of A. and The U. of C., APEGGA officials and Dr. Kolesar and his Assistants were present, was called to discuss 'the demand and supply of engineers over the next decade'. Those present agreed that 'the demand for engineers would remain high for the next 10 years'. The Deputy Minister also indicated that the Government and DAEM were well disposed towards expansion of the faculties at Calgary and Edmonton (see EFC Minute #8, 4.3 Dec. 17, 1981).

Optimism about the possibilities for expansion reached euphoric levels during the following weeks. The Dean, Dr. T.H. Barton, at the request of the U.P. (Academic) Dr. P.J. Krueger submitted an 8 page draft proposal dated Dec. 11, 1981, dealing with the Faculty's long-term academic and space expansion plans. An expanded version of this document was discussed by EFC on Jan. 21, 1982. It projected an increase in undergraduate student numbers of approximately 67%, from the then current 1,231 to 2,000 by 1990, with a 50% increase in staff and facilities at a capital cost of some \$80.0 million and an increase in the Faculty's annual operating budget to \$10.0 million (10/5.8 = 1.71, i.e. 71%). The final revised plan for *Expansion of the Faculty of Engineering*, dated Jan. 31, 1982, was discussed by GFC on March 25, 1982 and an expansion of engineering undergraduate enrollment to 2000 by 1990 approved for academic program and space planning purposes.

As a follow up to the Dec. 4, 1981 meeting and to discuss the Faculty's proposal for expansion, Dr. Fred Ogilvie from DAEM was invited to meet with the Dean and Department Heads in the Faculty on Wednesday, Jan. 27, 1982. The Acting Head, Dr. Doige gave a brief summary of the discussion at the Departmental Council meeting on Feb. 3, 1982, according to which DAEM requested the Faculty to submit a proposal for expansion to 2,000 students by 1990, involving expenditures of \$83.0 million for buildings, \$12.0 million for new capital equipment and \$10.0 million annual operating expenses. The Department will request

1,500 ASM in an extension to B-Block to accommodate an enrollment of 120 students in each of the 3rd and 4th year taught in 2 sections of 60 students in each year. Dr. Johnson suggested that planning should aim for 3 sections of 50 students in each of the junior and senior years. Dr. Doige concluded by noting that the Department's plans for expansion should be in the Dean's hands during the term, i.e. before the end of April 1982.

Upon returning from his sabbatical year on June 30, 1982 the Head found that no expansion plan submission had been made in the intervening months, the outlook on the need for expansion had changed drastically after the oil-patch boom had gone to bust during the spring of 1982. Despite the general lack of optimism, the Head began to write a comprehensive report on the Department's future development and its existing space needs. By Christmas '82 he had completed a 56 page document entitled *Mechanical Engineering Space and Manpower Requirements: A Plea for Immediate Action*, Dec. 1982 which he submitted to the Dean, the Vice-Presidents and the President on Jan. 14, 1983. He also sent a copy to DAEM. In it Dr. Glockner documented the critical space and manpower shortfall which existed in the Department over a period of several years and recommended a more than 100% increase in academic and support staff to eliminate the shortage and accommodate the planned and approved expansion of the Faculty. He also proposed construction of a new Mechanical Engineering Extension with 3,850 ASM at an estimated cost of \$18.75 million (1982 dollars), to be completed by the Fall of 1985. Space and manpower implications of a proposed new programme on CIM, although described briefly in Chapter 7 were not included in the figures and recommendations of the document.

After the *Letter of Intent: BSc Programme in Computer Integrated Manufacturing, CIM*, was approved at EFC on March 3, 1983 the Department was hopeful about its programme and expansion proposal despite the prevailing bleak economic outlook. At a meeting of Dean's Advisory Council, DAC, on March 8, 1983, Faculty expansion was discussed. Enrollment projections by the Dean for 1990, suggesting 100 students in each of the junior and senior years for each of the 4 departments, prompted a number of questions. Civil Engineering wanted to know how the enrollment growth in surveying engineering would be accommodated. Mechanical Engineering pointed out that their enrollments could easily have reached and possibly even exceeded 100 students in each year if all applications for entering into the Department had been approved during the previous several years. Thus existing enrollments would suggest realistic class sizes for 1990 to be in the range of 125-150 students for Mechanical Engineering. To support his argument, the Head sent the Dean 3 different enrollment projections the day after the meeting, on March 9th.

At the next DAC meeting on March 29th, after a long discussion, it appeared that agreement had been reached for a Faculty expansion plan which would include proposals for immediate expansion of the Chemical and Mechanical Engineering and the Common Core/Central Wings, and point out the space need implications of the proposed Computer Engineering Programme. The Dean was to draft a proposal, addressed to Dr. Krueger, and circulate it to the Heads for comment.

Instead of such a draft proposal, a week later the Dean sent a memo to the Head dated April 5, 1983, in which he informed the Department that the Faculty's plan for immediate expansion would include only the Chemical Engineering proposal with the Common Curriculum/Central Wing extension added. He suggested that Mechanical Engineering proceed on its own and prepare either a

Type A - new programme proposal for the CIM programme with appropriate building extension, or alternatively a *Type B* - programme expansion proposal with the necessary additional facilities. He noted that the latter was preferable in his as well as the v.P. (Academic)'s opinion. Not much additional clarification was obtained from the Dean when he tried to explain the rationale for his decision at a special departmental meeting, called for April 15, 1983. As the minutes of that meeting indicate, he could not be persuaded to change his mind and stated repeatedly 'that is the way it will be done'. Thus the Faculty expansion plan which was submitted did not include the needs of Mechanical Engineering, the unit with the largest demonstrated space shortfall in Engineering at the time.

The Head was subsequently forced to spend a substantial portion of his time during the remainder of 1983 in preparing yet another extensive report, *A Proposal for the Expansion of the Mechanical Engineering Undergraduate programme at The University of Calgary*, a document which became part of a *Letter of Intent* for a *Type B* programme expansion proposal approved by Departmental Council and by EFC on Nov. 30 and Dec. 1, 1983, respectively. The proposal was also presented to PPC early in 1984 but neither it nor the earlier CIM *Letter of Intent* reached DAEM. The deepening recession effectively moth-balled all of the Faculty's proposals for new programmes and programme or building extensions, whether they were submitted to Advanced Education or died in-house. Development of the CIM specialization, however, continued despite these setbacks primarily through resource reallocation within the Department and the Faculty. The space problem in Mechanical Engineering continued until some relief was obtained in 1991 by moving into leased facilities, the Petro Canada Building. Only time will tell just how permanent or temporary this partial solution will be.

Towards Computer Integrated Manufacturing, CIM

The *Letter of Intent*, *BSc in CIM*, approved by the Department and EFC on Dec. 2, 1982 and March 3, 1983 respectively, foresaw staged development of undergraduate and graduate education in this area, including the following 3 main phases:

- institution of an Undergraduate Elective Stream in CAD/CAM/CIM
- introduction of a BSc Minor and an MEng Programme in CIM;
- Establishment of a Division of CIM and introduction of a BSc in CIM leading to a separate Department.

Even though the *Letter of Intent* was shelved soon after its approval, due primarily to the prevailing economic climate after 1982, progress was made in phasing in a CIM capability in the Department particularly after the establishment of the CIM Centre, as described above. Also, research was initiated and starting in 1982 Drs. O.R. Fauvel and D.H. Norrie were co-supervisors of the first graduate students in CIM: Messrs. G.A. Roy and J. Vaidyanathan, who became the Department's first CIM graduands, obtaining their MSc degrees at the Fall '84 convocation. The first graduate courses in CIM, ENME 619.57 *Special Problems in CAM* and ENME 619.65 *Special Problems in CAD* were offered in the Fall '83 and Winter '84 terms by Rod Fauvel and Doug Norrie, respectively. Undergraduate course offerings in CIM had also increased during the previous 2-3 years - see Table H-1 - starting with revisions to the basic design courses in 1981-82.

These revisions were introduced only a year after a new design course sequence, ENME 531 *M.E.*

Design I and ENME 533 *M.E. Design II* had replaced the Department's traditional senior design courses ENME 587 and ENME 583 res.

Further changes were suggested by Prof. Allan Torvi, who as Chairman of the Curriculum Committee was sensitive to and was influenced by the deliberations of the Ad-Hoc Committee on Industrial/Production Engineering and by the growing interest in and emphasis on CAD/CAM in industry. In a memo dated Sept. 17, 1980, he suggested changes to the design portion of the Mechanical Engineering curriculum, and after discussing it with the Curriculum Committee, developed 3 separate courses, one for each of the area of *design, computer-aided design, and project and production engineering*. At the Departmental Council meeting on Sept. 19, 1980, three new design courses were approved, namely ENME 537 - *M.E. Design*, as replacement for ENME 531, ENME 539 *Computer Aided Design* which took the place of ENME 533, and a further optional course ENME 541 *Project and Production Engineering*, all of which were introduced in the 1981-82 academic year (see Table H-1). The Departmental curriculum also included a course on *Manufacturing and Production Processes* from the time of initiation of the programme, as well as the optional course on *Production Operations Management*, discussed above (see Table H-1). Further CIM course offerings introduced included undergraduate courses on CAD/CAM (ENME 543), on computer control of dynamic systems (ENME 545), and on the use of finite elements in CAD/CAM (ENME 547), as well as graduate courses on knowledge-based systems (ENME 619.77) and problems in manufacturing techniques (ENME 619.80). With such course selection, educational opportunities in CIM were available to undergraduates, through a sequence of electives, as well as to MSc and MEng candidates. An official Minor in CIM however remained an elusive goal until development was suddenly accelerated in 1987-88 by a number of events.

On Dec. 9, 1987, a special meeting of Departmental Council was convened for the purpose of discussing the development of CIM activities and programmes in the Department. The Acting Head Dr. A.G. Doige reported on the joint Western Universities Computer Integrated Manufacturing proposal (WUCIM) which was initiated by Prof. Hsu of the University of Manitoba and received strong endorsement at a meeting of the Canadian Engineering Deans in Guelph, Ontario, in November. Prof. Doige noted that the proposal would access the Western Diversification Initiative Fund (WDI), and gave a brief summary of his visits with Prof. Hsu to all western Canadian Universities for the purpose of gathering information and gaining support. Dr. Norrie and members of Council were enthusiastically in favour of this initiative.

A second issue discussed was the establishment of a Chair in CIM. The Dean had indicated that he would support a campaign to raise matching funds from NSERC through its Industrial Research Fellowship programme.

Next, Dr. Doige informed his colleagues that if the Department were to request a new academic position for the CIM area, it would likely be approved since there was to be some re-allocation of resources within the Faculty in the near future.

The meeting concluded on a motion by Drs. Mikulcik and Fauvel, stating that the Department

- reaffirms its support for developing the CIM area, as stated in the 1983 *Letter of Intent*
- supports the appointment of a new academic staff member in the CIM area
- supports the decision to pursue an NSERC Industrial Chair in CIM
- supports the joint WUCIM proposal.

a motion which was approved unanimously.

Concern was expressed about the shortage of technical staff in the CIM field which resulted in a further motion by Drs. Vermeulen and Rowe requesting 'the Dean to consider the urgent need for additional technical staff to support the CIM area' also passed unanimously.

At the Jan. 22, 1988 meeting of Council, Dr. Doige was pleased to announce that a new academic position for the CIM area had been allocated to Mechanical Engineering.

Further focusing on the Department's programme development and options took place at a full day meeting of Departmental Council held during the spring reading week on Feb. 22, 1988. Topics of discussion included developments in CAD/CAM/CIM, integration of computing into the departmental curriculum, computer assisted learning, CAL, and the introduction of a Minor in CIM. The latter proposal by Dr. Norrie being approved in principle at Council's meeting on June 30, 1988. Launching of the Minor was to be subject to appropriate funding being available.

With the support of the Dean, the new Head, Dr. G.T. Reader, proceeded to implement Council's decision. On May 31, 1989, the Dean announced in EFC the transfer of the Matsura CNC machining centre and support staff from the Faculty to Mechanical Engineering, effective April 1, 1989, and informed members of Faculty Council that the BSc Minor in Computer Integrated Manufacturing would start in Sept. 1989. Introduction of the Minor led to the approval and offering of several additional undergraduate courses in this specialization (see Table H-1).

The Manufacturing Engineering Division and BSc Programme

The inauguration of the CIM Minor in Sept. 1989 was followed closely by approval, in principle, of the *BSc Manufacturing Engineering programme proposal* at the Departmental Council meeting on Nov. 16, 1989. At the same meeting, the issue of a *Division of Manufacturing Engineering* was raised by the CIM Group, spearheaded by Dr. D.H. Norrie. Establishment of a Division was approved by Council at its meeting on April 21, 1990. Within a few weeks, Doug Norrie was selected and subsequently appointed Associate Head and Head of the Division of Manufacturing Engineering, effective Oct. 1, 1990.

The BSc Manufacturing Engineering programme proposal was introduced at the meeting of EFC on Nov. 21, 1989, where it was endorsed and referred to the Faculty's Academic Review Committee. On June 1, 1990 it was brought back and approved, in principle, with final approval given by EFC on Feb. 6, 1991. Almost 2 years passed before institutional approval was completed, including endorsement by the Academic Program Committee, APC, on March 10, 1992, by the University Planning Committee, UPC, on Nov. 25, 1992, by GFC's Executive Committee on Dec. 1, 1992 and Jan. 5, 1993, by GFC on Jan. 14, 1993 and final approval by the Board of Governors on March 19, 1993.

The Division with its staff is a thriving organization, looking after courses for the CIM Minor, the graduate course offerings in this area and expanding graduate study and research in various CIM specializations. The programme is one of the most successful developments in the Faculty and represents the most recent expansion in Engineering, as of 1993.

APPENDIX J

SURVEYING ENGINEERING AND THE NEW CIVIL ENGINEERING WING

To place the events leading up to the approval of the BSc Surveying Engineering programme and extension of the Civil Engineering Building at The University of Calgary into proper perspective let us briefly review the history of the Surveying profession's pursuit of the establishment of such a degree programme at a Western Canadian University during the period 1958-79. Such a review will indicate why the implementation of the programme at Calgary in the Fall of 1979 represented a *dream come true* for the Surveying profession in Western Canada.

The launching of artificial satellites, representing the dawn of space exploration and demanding increased precision in all aspects of surveying, fortunately coincided almost precisely with the invention of electronic distance measuring devices, including the tellurometer in 1957. These developments brought about suggestions for four or five year University degree programmes for the education of Surveying professionals. The Canadian Institute of Surveying, CIS, prepared a programme proposal with detailed course outlines, and took it to the Universities of Carleton and Ottawa, with no success.

The first suggestion for a university degree programme in Surveying Engineering in Western Canada was made at the 49th Annual Meeting of the Alberta Land Surveyors' Association, ALSA, on January 22, 1958, when their Secretary-Treasurer, J. H. Holoway introduced a resolution recommending the establishment of four year Surveying Engineering degree programmes at a University in each of Eastern and Western Canada. The resolution was passed unanimously by the ALSA members present. Consequently, a brief was prepared and submitted to the President of the University of Alberta in 1958 which was referred to the Faculty of Engineering for study and possible action. Due to other priorities this submission was held in abeyance and no action was taken by the ALSA for some 8 years. In the meantime, the CIS sponsored its First Colloquium on

Surveying Education in 1959 as a result of which the Surveying Engineering programme was established at the University of New Brunswick (UNB) in 1960. In 1966 the CIS held its Second Colloquium on Surveying Education which led to the establishment of the Survey Science programme at Erindale College of the University of Toronto in 1968. The Saskatchewan Land Surveyors' Association, SLSA, proposed a three year Surveying programme for the Faculty of Arts at the University of Saskatchewan in 1966, a proposal which was never implemented.

In view of the lack of response from the U of A to their 1958 submission, the Education Committee of the ALSA suggested in 1966 a third year for the existing two year Survey Technology programmes at SAIT and NAIT. It also proposed that the diploma from such a three year programme be established as the educational qualification required for registration as an ALS. This suggestion was strongly opposed by Dean R. M. Hardy at the U of A, as a result of which the Committee withdrew its proposal and renewed its efforts to have a Surveying Engineering programme established at the University of Alberta. This activity led to the Engineering Faculty Council (EFC) at the U of A passing a motion which recommended the establishment of a Surveying Engineering Option within Civil Engineering, to be implemented in the Fall of 1968. The surveyors in Alberta greeted this development with great enthusiasm and did everything within their power to facilitate its implementation. Although funds were allocated for the programme, delays in recruitment occurred which resulted in reallocation of the funds and a postponement of the initiation of the programme. In 1970 the ALS submitted a second brief urging the Faculty of Engineering to place high priority on the implementation of the Surveying Engineering Option. The Faculty promised to try to start the programme during the 1971-72 academic year. Severe financial cutbacks introduced in 1972 forced the Faculty to

abandon its plan and the ALS was so informed. In 1974 the Department of Geography at the U of A established a Survey Science programme, without extra funding or staff, utilizing only existing courses and facilities. The programme was not ideal but it served as an interim solution for providing education to surveyors in Alberta and Western Canada. Low enrolment in the programme, together with lack of funding, ultimately led to its cancellation.

First contact with the U of C was made by Mr. Alex L. Hittie, Survey Manager for Shell Canada Resources Ltd. in Calgary in 1975 when he proposed the establishment of a Geodetic Research Institute at The U of C. Although the University's final response was negative, Dean T. H. Barton and Professor M. A. Ward showed sympathy for and interest in providing educational opportunities for the surveying profession. Events accelerated when the CIS held a meeting in Edmonton on December 4, 1976, for the purpose of reviewing the facilities for and to make recommendations on the education of professional surveyors in Western Canada. A decision was made to prepare a brief recommending a Surveying Engineering BSc degree programme somewhere in Western Canada and to present a copy of that brief to the four Western Canadian provincial governments.

While the surveyors were pursuing their long-standing *dream* for a University degree programme in Surveying, the Civil Engineering Department at The U of C and its Head, Dr. M. A. (Mike) Ward were looking anxiously for a way to have funding for the rebuilding expansion approved and construction started at an early date. With the freeze on all new capital construction instituted by the Provincial Government in late 1975, the probability of that long-awaited much needed Civil Engineering extension becoming a reality was decreasing with every passing week. It was clear to all members of staff in Civil Engineering that in view of the financial constraints experienced by the Government, a simple restatement

¹Hittie, Alex, 'The Pursuit of a Degree Program in Surveying for Western Canada', The Canadian Surveyor, Vol. 33, No. 4, Supplement, December 1979, pp. 393-395.

²Usher, W.D., 'History of the Establishment of a Degree Course in Surveying Engineering', ALS News, Vol. VIII, No. 4, Fall 1979, pp. 16-18.

of the severe shortage of general laboratory and student space in the department was not going to result in any change in the government's decision.

It was therefore fortuitous that on December 17, 1976 Mr. Alex Hittel who was also an executive member of the ALS and Mr. Ed Scoville, Sessional Instructor in the Department of Civil Engineering during 1976-77 and Surveying Instructor at SAT, invited Mike Ward for a luncheon date. They presented the ALS's case for an initiative in an Undergraduate Surveying Engineering programme and pointed out that their efforts in having such a programme initiated at the U of A were unsuccessful even though much of the support from within the profession came from colleagues in Edmonton. They reported on the meeting of the CIS which was held in Edmonton on December 4, 1976 and the decision to prepare a brief recommending the establishment of a BSc Surveying Engineering degree programme at a University in Western Canada. Since the meeting in Edmonton had been attended by representatives of the four Western Canadian Surveying Professional Associations, in addition to members of the Canadian Council of Land Surveyors and the Chairmen of the Western Branches of the CIS, it was clear that the Western Canadian Provincial Surveying organizations had reached a consensus and had decided to give strong support to this educational initiative. They pointed out that the only Surveying Engineering programme in Canada existed at UNB which was very successful and highly regarded. The Surveying programmes at Laval University in Quebec and the Erindale College of the University of Toronto were surveying science programmes. They emphasized that the surveying profession preferred a Surveying Engineering rather than Survey Science programme established at a Western Canadian University. Mr. Hittel expressed concern that the type of graduate required by the surveying industry in Western Canada was not available.

Upon reflection Dr. Ward decided that even at this stage the proposal from the Surveying profession 'was well thought out and made a great deal of sense'.² In addition it was also clear that implementation of such a programme would require additional space in the Faculty of Engineering and that this proposal would therefore provide a very strong argument for urgent building expansion,

perhaps sufficiently convincing so as to influence the Government to allow a thaw in their new capital construction freeze. Reflecting on these matters, the possibilities became quite intoxicating!³

He arranged a meeting between Dean Barton and Messrs. Hittel and Scoville two days later at which time he obtained the Dean's support for proceeding to obtain University approval for such a programme.

After initial private discussions amongst the Civil Engineering Department staff, Dr. Ward arranged a meeting of the Department on Wednesday, January 19, 1977 to which he invited the following individuals: Dean T.H. Barton, Mr. Dave Jsher, Incoming President of the Canadian Institute of Surveying, Mr. Don Dawson, Chief Surveyor, Mobil Oil, Edmonton, and Executive member of ALS and Alex Hittel. Mr. Hittel reviewed the current status of the efforts of the Alberta Land Surveyors to establish a Surveying Engineering degree programme at a Western Canadian University. He told those assembled that the ALS had been working towards this goal since 1958 and had reached the stage where submissions for the establishment of a Surveying Engineering programme had been made to the Departments of Advanced Education in each of the four Western provinces. The submissions were being considered by the Western Canadian Post-Secondary Education Coordinating Committee of which our own Deputy Minister of Advanced Education, Mr. Julian Koziak, was currently the Chairman. Information from that Coordinating Committee indicated that if such a programme were to be established in one of the Civil Engineering Departments in a Western Canadian University, the cost of running the programme might be shared by the four Western provinces along the lines of the Veterinary Science programme established at the University of Saskatchewan earlier.

In response to a question Mr. Hittel stated that the Surveying profession might donate equipment to such a Surveying Engineering Department. He also expressed the hope that funds could be found within the profession for the establishment of a Chair in Surveying Engineering. He closed by saying that the Surveying Engineering programme at UNB had obtained considerable funds from the Department of Energy, Mines and Resources, EMR

and the National Research Council, NRC.

Mr. Jsher commented on the size of the programme by stating that it is expected to attract between 25-30 candidates per year, the approximate requirement for surveyors in Western Canada. This demand could be exceeded since the estimate did not include the needs of municipalities. Professionals with Surveying Engineering backgrounds are required to manage the local survey groups in the municipality.

In a response to a question as to whether or not the Surveying Engineering programmes at UNB and at Erindale College in Toronto were operating at saturation, Mr. Hittel stated that it was not so much a question of whether there was any space left in those programmes in the east but rather a question of establishing a Surveying Engineering programme in this part of Canada which was specifically designed for the needs of Western Canada and the developing north.

A week later a departmental meeting was held to review the issue of a Surveying Engineering programme proposal. After considerable discussion it was moved by Mr. A. Huizer and seconded by Dr. W. Deger that this Department supports in principle the establishment of a Surveying Engineering programme in this Faculty on the understanding that such a programme would be funded from new money with due cognisance being given to space requirements. It is also understood that although in the first instance the programme would be managed by the present Department of Civil Engineering, the objective is to establish an autonomous Department of Surveying Engineering. The motion was carried unanimously.

A proposal was taken to EFC on February 17, 1977 where it was moved by M.A. Ward and seconded by A.E. McMullen that 'this Council approves the transmittal of a Letter of Intent to the Department of Advanced Education, committing this Faculty to develop a formal proposal, with the object of establishing a Surveying Engineering programme at The University of Calgary, for the eventual consideration of EFC, GFC and ultimately the Department of Advanced Education'. There was considerable discussion of the motion during which Dr. Ward stated that the Land

²Ward, M.A., 'Surveying Engineering and the New Civil Wing' private memo to the writer, Sept. 2, 1991, 2 pages.

Surveying Associations in Ontario, New Brunswick and Alberta are adopting a Surveying Engineering degree as a requirement for membership in their Association. He felt that our strong common core would provide a sound basis for a Surveying Engineering programme. He also felt that no substantial additional teaching load would result from the institution of such a programme. To questions as to whether or not a new Department of Surveying Engineering was to be established, the Chairman, Dean Barton, responded by stating that at the present there was no intent of setting up a large administrative structure to deal with Surveying Engineering. It would initially be housed in Civil Engineering and would be a Division within that Department until such time that the establishment of a separate Department of Surveying Engineering is warranted. Both he and Dr. Ward believed that the Faculty could and likely would graduate 30-40 surveying engineering students per year. He also expressed the opinion that the probability of such a programme being approved and funded by the Department of Advanced Education and Manpower, DAEM, was very high. It was agreed that the Letter of Intent would be prepared by the Civil Engineering Department, a document which would be a complex statement of the needs of the Faculty in connection with such a programme proposal and how those needs would be met. The motion was carried.

Dr. Ward noted in his private diary that on May 9, 1977 there was a Surveying Seminar in Edmonton, organized by CIS, at which he presented a talk about the Calgary Surveying Engineering programme proposal. The seminar concluded by approving the brief entitled 'The Education of the Professional Surveyor in Western Canada' and authorizing its distribution to all universities and governments in Western Canada. Mike Ward recalls that it was at that meeting that colleagues from our sister Engineering Faculty showed the first interest in such a programme, especially since it was clear that it might be implemented at The U of C. Consequently, much discussion and heavy debate occurred during the next few months about the merits of such a programme and at which university it should be offered. The Surveyors from both cities, however, were, by that time, 'fully committed to the Calgary-driven proposal'.³ Their support was steadfast to the end.

There was also much debate and many

discussions and meetings both internally within the Department and with the Surveying Engineering profession during the coming months. As a result of these discussions, agreement was reached that the best overall benefit for the Department of Civil Engineering and the new proposal would be achieved by renovating the E wing for Surveying Engineering and constructing a new building for Civil Engineering. It was agreed that the needs for physical facilities and space of the new Surveying Engineering programme could easily be provided and created in a renovated E wing while the laboratory requirements, particularly a structural research laboratory for the Civil Engineering group, could only be obtained by starting from a totally new building plan.

After the Letter of Intent had been endorsed by the various institutional committees and councils, it was sent to DAEM which informed The U of C in June 1978 that permission to prepare a detailed proposal for a Surveying Engineering programme was granted. The time for hard work had arrived. It was at this stage that Dr. E.J. (Ed) Krakiwsky appeared on the scene when Alex Hittel brought Ed to Calgary in the late Spring of 1978 to work with Shell and also to help in preparing the detailed proposal accompanying budget and educational programme details of the new Surveying Engineering curriculum. In the opinion of Mike Ward, without the help and initiative of Ed Krakiwsky during the Summer of 1978, 'the initiative may very well have stalled or at best would not have had as smooth a sailing from then on as it did'.³ He always felt that supporting Ed's visit during the Summer of 1978 and his eventual move to Calgary was probably his best decision as a Department Head in Civil Engineering.

On September 13, 1978 Mike Ward met with Mr. Jim Hamilton in the Controllers Office to 'put the final touches on the budget for the Surveying Engineering programme' prior to the formal submission of the proposal to DAEM. The last hurdle within the institution, approval by GFC, was obtained on November 9, 1978. After the Board had given its blessing to the programme proposal, it was forwarded to the Department of Advanced Education and Manpower in late 1978 and the 'waiting and guessing game' started. It is to the credit of Mike Ward that he wisely decided to be prepared for the approval of the proposal which meant more than initiation of the Surveying

Engineering programme. It had coupled to it and implementation of the programme was conditional to the approval of the proposal for a Civil Engineering Extension.

He proceeded to make definite commitments to start the programme in the Fall of 1979. Applicants were informed about the possibility of a Surveying Engineering programme in September 1979 so that about a dozen or more students were committed to come to Calgary should the programme be initiated. In order to have a programme in place, Mike Ward had Faculty Council approve the third year Surveying Engineering programme in May 1979 which was subsequently approved by GFC and the Board, ready to be implemented in September should the Government give the *green light* to both proposals.

During the first six months of 1979 Mike Ward's diary indicates numerous meetings with Ed Krakiwsky. It was clear to both of them that despite the economic boom in the province, approval of the programme proposal was far from guaranteed especially since it had a condition for construction of a Civil Engineering Extension coupled to it. And this was proposed during a period of moratorium on a new capital construction which had been instituted by the Government in 1975. Despite these uncertainties, Ed Krakiwsky decided to return to Alberta. But first he secured himself a position as Manager of Surveying Research at Shell Canada Resources Ltd. His arrival in Calgary coincided almost exactly with the announcement on June 15, 1979 in the Alberta Legislature of the approval of the Civil Engineering Building Extension at The U of C by the Hon. James Horsman. Since this building extension proposal was part of the Surveying Engineering BSc programme proposal, the announcement indirectly also indicated the Government's positive decision with respect to the programme. These developments added joy and excitement to the *homecoming* of the native Calgarian after 17 years of study, teaching and research at The Ohio State University (OSU), the UNB and the Centre National d'Etudes Spatiales in Toulouse, France. Prior to going to OSU, Ed obtained a Diploma in Surveying Technology from SAIT in 1959 after which he spent two years with the City of Calgary Engineering Department and two years in Mathematics at the JAC. After obtaining his BSc, MSc and PhD from OSU, he joined UNB in 1968 as Assistant Professor of Surveying Engineering. During his 11

years at UNB he helped to build the geodesy section of that new department into an internationally recognized group.

The announcement in the legislature resulted in some quick negotiation between Mike Ward and senior officials at Shell Canada, ending in the release of Ed Krakiwsky from his employment commitment so as to enable him to become Chairman of the Division of Surveying Engineering with a Civil Engineering at The University of Calgary effective July 1, 1979. Formal approval for funding of the new programme was announced on July 9, 1979 in the form of a \$2.65 million four-year programme development grant. Tentative job offers for appointment in Surveying Engineering were sent to Drs. J. A. R. (Rod) Bais and Klaus-Peter Schwarz within days after the Minister's announcement in the legislature.

The third year Surveying Engineering programme was started in September 1979 with a class of approximately 12 students, an event which was a *dream come true* for most surveyors in Western Canada. The programme was designed so as to meet the academic requirements for registration as a professional engineer, P.Eng., a Canada Lands Surveyor, C.L.S., and a Professional Land Surveyor in the Western provinces, B.C.L.S., A.L.S., S.L.S., and M.L.S. Since Calgary was to serve the educational and research needs in surveying for a lot of Western Canada, transfer programmes between the U of C and nine post-secondary institutions in the West were established during the first year of the programme. Transfer into the third year Surveying Engineering programme at The U of C from the Universities of Alberta, B.C. (Regina, Saskatchewan, Saskatoon), and Manitoba was direct and unconditional after satisfactory completion of the first two years of the undergraduate programme at those institutions. A transfer from the surveying technology programmes at BCIT, NAIT, SAIT and Red Deer College involved additional first and second year courses which the transferring student would have to take, usually requiring three years for completion of the last two years of the Surveying Engineering programme at The U of C.

The programme was officially opened by the Minister's representative Dr. Fred Ogilvie, Director of Degree Programmes at DAEM, on September 4, 1979, the first day of a Geodetic Seminar organized by the new Division Chairman. After the seminar the newly formed Surveying Engineering Advisory

Committee had its inaugural meeting on Sept. 6, 1979 with the following 11 of its 16 industrial members and the staff of the Division in attendance: Messrs. G.K. Alfred, Secretary Treasurer and Registrar of A.L.S.A., Edmonton; K.M. Bridge, B.C. Surveys and Mapping Branch, Victoria; Alex L. Hittell, Manager-Surveying, Sheltach, Calgary; N.R. Mattson, President A.L.S.A. & President of Coordinate Surveys Ltd., Edmonton; K. Pawson, City of Calgary; W.G. Robinson, Underhill & Underhill Engineering Ltd., Vancouver; G.M. Thomson, Thomson Surveys, Victoria; J.B. Turnbull, Surveys Branch of Land Titles, Regina; W.D. Usher, Land Survey & Engineering Consultant, Edmonton; C.W. Youngs, Director of Surveys and Mapping Branch, Edmonton; J.M. Zarzycki, Director Topographical Survey, Energy, Mines and Resources Canada, Ottawa; and Drs. J.A.R. Bais, E.J. Krakiwsky, K.P. Schwarz and M.A. Ward. Absent were Messrs. M. Bolton, Institute of Ocean Sciences, Sidney; B.C. C. Everett, Prairie Surveys Ltd., Regina; N. Payne, City of Winnipeg; Land Surveyor, Winnipeg; A.C. Roberts, Manitoba Dept. of Mines, Natural Resources and Environment, Winnipeg. At its first meeting the Committee established its terms of reference as follows: The Advisory Committee assumes the responsibility of ensuring that the undergraduate, graduate and research programmes meet the needs of the country, paying special attention to Western Canada, and are kept up to date with our society and changing technology.

At the September 20th meeting of EFC, Dr. Barton expressed his appreciation and that of the Faculty to everyone who had been involved in the preparation of the Surveying Engineering programme proposal and the proposal for the extension of the Civil Engineering Building, especially lauding the efforts of Drs. Ward and Krakiwsky and members of the Surveying profession with particular emphasis to the contribution by Mr. Alex Hittell. In October 1979 EFC approved the first Surveying Engineering calendar submission, while at the May 21, 1981 EFC meeting a Letter of Intent for expansion of the Civil Engineering graduate programme to include Surveying Engineering was given approval, a proposal which was subsequently approved by GFC and by the Board and was implemented. There were 8 graduates from the Surveying Engineering programme in the Spring of 1981.

In September 1983 the Division of Surveying Engineering, with the support of the Civil Engineering Department, requested departmental status, a request which was approved by EFC. It took a further 3 years before Surveying was officially admitted as a fifth department in the Faculty of Engineering at The University of Calgary in the Fall of 1986. In the meantime, in September 1984, E.J. Krakiwsky was reappointed Chairman of the Surveying Engineering Division. The procedures used in that appointment were those for appointment of Heads of Departments so that Dr. Krakiwsky would be ready to become the first Head of the Surveying Engineering Department when the Division became a Department. On November 20, 1986 he did become and for the next 30 months was Head of Surveying Engineering before going on a sabbatical leave on July 1, 1989. Dr. G. Lachapelle was Acting Head until Dr. Klaus-Peter Schwarz started his term of office on Jan. 1, 1990.

The tremendous effort expended by Ed Krakiwsky, staff members in Surveying Engineering and their colleagues in the profession in creating the Surveying Engineering programme and department at The University of Calgary has brought rich fruits. Very substantial equipment donations have been received. A Professorship in Cadastral Surveying has recently been established with contributions from the four Western Canadian Surveying Associations. Dr. Alec McEwen has been appointed to that Professorship effective January 1, 1991. The Department has graduated the first 2 women to have received a PhD degree in Surveying Engineering in Canada, at the Fall 1990 and the Spring 1991 Convocations respectively.

All in all, the Surveying Engineering programme and the establishment of the Surveying Engineering Department has been one of the most successful undertakings in the history of our Faculty. As a result of this programme the long awaited and much needed Civil Engineering wing was finally built (1980-1982) and stands as evidence to one of Mike Ward's major contributions to this Faculty before he became Vice President (Research) on July 1, 1984. On the basis of what has been briefly reviewed above, one might easily agree with Dr. Ward that 'the way this proposal was initiated and put forward can serve as a model for any such new initiative, particularly in times of financial constraint'.³

APPENDIX K

GLOSSARY OF TERMS AND ABBREVIATIONS

| | | | |
|----------|--|----------------------|--|
| A-Block | - Electrical Engineering Wing | C-Block | Central or Administration Wing |
| AAM | - American Academy of Mechanics | CAD | Computer aided design |
| A/C-ERRF | - Alberta/Canada Energy Resources Research Fund | CAG | Computer aided graphics |
| ACB | - Alberta Coal Board | CAL | - Computer aided learning |
| ACI | - American Concrete Institute | CAM | - Computer aided manufacturing |
| ACM | - Association of Computing Machinery | Can | - Canadian |
| ACR | - Alberta Coal Research | CANCAM | Canadian Congress of Applied Mechanics |
| AEC | - Alberta Energy Corporation | CANMET | - Canadian Centre for Mineral and Energy Technology (EMR) |
| AECL | - Atomic Energy of Canada Ltd | CCPE | - Canadian Council of Professional Engineers |
| AERT | - Alberta Environmental Research Trust | CE | Civil Engineering |
| AGA | - American Gas Association | CGPA | Canadian Gas Processors Association |
| AGT | - Alberta Government Telephones | ChE | - Chemical Engineering |
| AGTL | Alberta Gas Trunk Line Co. Ltd. (renamed NOVA Corp.) | Chemical Engineering | - Department of Chemical Engineering |
| AI | - Artificial Intelligence | CIDA | Canadian International Development Agency |
| AICHE | - American Institute of Chemical Engineers | CIL | Canadian Industries Ltd |
| AHMRT | - Alberta Heritage Medical Research Trust | CIM | Can. Institute of Mining |
| AMI | - Alberta Masonry Institute | CIM | Computer Integrated Manufacturing |
| AMC | Alberta Microelectronic Centre | Civil Engineering | - Department of Civil Engineering |
| AOSTRA | Alberta Oil Sands Technology and Research Authority | CMC | Canadian Microelectronics Corp |
| ARC | - Alberta Research Council | CMG | Computer Modelling Group |
| APEA | Association of Professional Engineers of Alberta (till June 1970) | CNGPA | - Canadian Natural Gas Processors Assoc |
| APEGGA | Association of Professional Engineers, Geologists & Geophysicists of Alberta (since June 1970) | CRDG | - Cooperative Research & Development Grant |
| ASCE | - American Society of Civil Engineers | CSA | Canadian Standards Association |
| ASEE | - American Society for Engineering Education | CSCE | Canadian Society for Civil Engineering |
| ASHRAE | - American Society of Heating, Refrigeration and Air conditioning Engineers | CSChE | - Canadian Society for Chemical Engineering |
| ASME | American Society of Mechanical Engineers | CSEE | - Canadian Society for Electrical Engineering |
| Assoc | Associate Association | CSME | - Canadian Society for Mechanical Engineering |
| Asst | Assistant | D-Block | - Chemical Engineering Wing |
| ASTech | - Alberta Science and Technology Leadership Awards | DAE(M) | - Department of Advanced Education (& Manpower) |
| ASTM | American Society for Testing and Materials | Dean | Dean of the Faculty of Engineering at The U of C (at U of A before 1965-04-01) |
| ATRC | Alberta Telecommunications Research Centre (renamed TEL) | DENR | Alberta Department of Energy & Natural Resources (also: ENR) |
| AVLN | - Automatic Vehicle Location and Navigation | Diploma | - Post-BSc degree of the Faculty of Engineering |
| B-Block | - Mechanical Engineering Wing (until 1991) | DPW | - Alberta Department of Public Works |
| B & K | - Bruel & Kjaer Canada Ltd | DRB | - Defence Research Board |
| Board | - Board of Governors of The U of C (the U of A prior to 1965-04-01) | DRES | - Defence Research Establishment Suffield |
| | | DREP | - Defence Research Establishment Pacific Victoria |
| | | DSS | - Dept. of Supply and Services, Ottawa |

| | | | |
|------------------------|---|------------------------|---|
| E-Block | Civil Engineering Wing until 1982 then Surveying Engineering Wing | RAP | - Industrial Research Assistance Programme |
| EE | - Electrical Engineering | UTAM | International Union of Theoretical & Applied Mechanics |
| Electrical Engineering | - Department of Electrical Engineering | Limited Term | - Appointment for a specified period |
| EFC | - Engineering Faculty Council | LNG | - Liquid Natural Gas |
| EIC | - Engineering Institute of Canada | ME | - Mechanical Engineering |
| EM | - Engineering Mechanics | Mechanical Engineering | - Department of Mechanical Engineering |
| EMO | - Emergency Measures Organization, Ottawa | MRC | Medical Research Council of Canada |
| EMR | - Dept. of Energy, Mines and Resources, Ottawa | NDG | Negotiated Development Grant (NRC) |
| ENR | Energy & Natural Resources, Dept. of (A.B.) | NRC | - National Research Council of Canada |
| Engineering | The Faculty of Engineering | NSERC | Natural Sciences and Engineering Research Council of Canada |
| ENCH | - Chemical Engineering course designation | NSF | - National Science Foundation, USA |
| ENCE | - Civil Engineering course designation | OIA(R) | - Office of Institutional Analysis (Research) |
| ENEE | - Electrical Engineering course designation | PAE | Petroleum Aid for Education Fund |
| ENGG | - Faculty of Engineering course designation | PAIT | Program for the Advancement of Industrial Technology |
| ENME | Mechanical Engineering course designation | PDF | - Post Doctoral Fellow |
| ENSU | Surveying Engineering course designation | PRAI | - Project Related Assistance to Industry |
| ERCB | Energy Resources Conservation Board (formerly Oil & Gas Conservation Board) | PRR | - Petroleum Recovery Research Institute |
| ERRF | Energy Resources Research Fund (also A/C-ERRF) | PS | - Petroleum Society |
| ESS | - Engineering Students Society | PSCIM | Petroleum Society of C.M. |
| F-Block | - Civil Engineering Wing (since 1982) | RTAC | Roads & Transportation Association of Canada |
| Faculty | - Faculty of Engineering | SAE | Society of Automotive Engineering |
| Faculty Council | Engineering Faculty Council | SCS | - Society for Computer Simulation |
| GFC | - General Faculties Council | Sessional | Appointee holding limited term appointment for 1 or 2 terms, full-or part-time |
| GPA | - Grade Point Average | SSHRC | - Social Sciences & Humanities Research Council of Canada |
| GPA | Gas Processors Association - Oklahoma | SU | Surveying Engineering |
| GPS | Global Positioning System | SUDIC | - Sulphur Development Institute of Canada |
| GRA | - Graduate Research Assistant Assistantship | Surveying Engineering | - Department of Surveying Engineering |
| GR | - Gas Research Institute - Chicago | TDA(C) | Transportation Development Agency (Centre) of the Ministry of Transport, Montreal |
| GSA | - Graduate Service Assistant Assistantship | TRT | - Alberta Ministry of Technology, Research & Telecommunications |
| GTA | Graduate Teaching Assistant Assistantship | TRL | - Telecommunications Research Laboratories (formerly ATRC) |
| Head | Department Head | UN SUL | University of C Interdisciplinary Sulphur Research Group |
| HP | Hewlett Packard | U-IC&R | - University-Industry Cooperative Research & Development (NSERC) |
| IASS | International Association for Shell & Spatial Structures | UAC | University of Alberta, Calgary |
| ICST | - Institute of Chemical Sciences & Technology | University | - The University of Calgary (the University of Alberta prior to 1966-04-01) |
| IDRC | International Development & Research Centre - Ottawa | VLS | Very Large Scale Integration (in electronic circuits) |
| IEEE | - Institute of Electrical & Electronics Engineers | ULS | - Ultra Large Scale Integration |
| INS | - Inertial Navigation System | | |
| Initial Term | - Appointment leading to tenure | | |
| Inst. | - Institute | | |
| Int. | - International | | |
| ORG | - Industrially Oriented Research Grant (NSERC) | | |
| IPAC | Independent Petroleum Association of Canada | | |

APPENDIX L

MONETARY VALUE INDICATOR - 1992-93 CALGARY BASE

| | \$ | | \$ | | \$ |
|--------------------------------------|---------------|--|---------------|---|---------------|
| 1 Basic Food | | Rent/month | | Automobile | |
| Bread-loaf | 0.90 - 2.50 | house | 750 - 1500 | compact, 000's | 10 - 15 |
| -buns/dozen | 1.50 - 2.50 | condominium | 750 - 1300 | mid-sized, 000's | 17 - 25 |
| Butter /kg | 4.50 - 6.50 | apartment | 500 - 1000 | full-sized, 000's | 25 - 80 |
| Cooking oil/ltr | 1.00 - 4.00 | Property tax/year | | van, 000's | 17 - 30 |
| Eggs-kg/dozen | 1.20 - 1.50 | house | 1,400 - 3,500 | motor home, 000's | 60 - 110 |
| Flour/kg | 0.40 - 0.70 | condominium | 800 - 2,500 | Gasoline /ltr | 0.40 - 0.50 |
| Fruits /kg | | Utilities | | Motor oil /ltr | 3.0 - 5.0 |
| apples | 0.90 - 3.00 | electricity/kwh | 0.062 | Motor vehicle registr./yr | 52 |
| bananas | 0.90 - 1.50 | electricity, basic chg/mth | 8.80 | Battery | 60 - 110 |
| oranges | 1.50 - 2.00 | water / m ³ | 0.0694 | Parking violations | 20 - 30 |
| Meats /kg | 11.00 - 12.00 | water, basic chg/mth | 7.75 | Speeding ticket | 60 - 200 |
| chicken (whole) | 4.00 - 4.50 | sewer /l 43% of water cost | | Annual car insurance | 300 - 800 |
| fish | 10.00 - 15.00 | heating natural gas/GJ = MCF | | Annual AMA fee | 60 |
| liver | 2.00 - 3.00 | pre Nov '93/GJ | 2.70 | | |
| pork chops | 7.00 - 8.00 | post Nov '93/GJ | 3.30 | 9 Entertainment & recreation | |
| shrimp | 24.00 - 28.00 | basic chg/month | 13.23 | Movie theatre/adult adm. | 8.00 |
| Milk (2%) /ltr | 1.00 | | | Theatre concert/adm | 15 - 50 |
| Salt /kg | 0.80 - 0.90 | 6 Real Estate | | Season ticket | |
| Soft drinks & water/ltr | 0.80 - 1.15 | Houses, 000's | 130 - 350 | concert, CPO | 80 - 400 |
| Sugar /kg | 0.70 - 0.85 | Condominiums, 000's | 70 - 250 | hockey | 674 - 2455 |
| Vegetables /kg | | Lots, 000's | 50 - 150 | football | 175 - 300 |
| broccoli & cabbage | 0.80 - 1.20 | Acreage/acre, 000's | 10 - 20 | Cablevision/yr | 250 - 325 |
| celery | 0.90 - 1.40 | Land/acre | 500 - 1,500 | Sports event/adm | 30 - 120 |
| cooking onions | 0.70 - 1.50 | | | City facilities | |
| peppers, green | 1.50 - 3.00 | 7 Communication & Information | | swimming/adm | 3.00 - 4.00 |
| red | 3.00 - 9.00 | Phone | | skating/adm | 3.00 - 4.00 |
| vegetables /bunch | | basic chg/month | 17.48 | golf/18 holes | 20.00 - 25.00 |
| carrots & spinach | 0.80 - 1.10 | pre May '93 | 15.65 | Private facilities | |
| green onions | 0.30 - 0.40 | pre June '92 | 12.68 | tennis bubble/hr | 6.00 - 8.00 |
| radishes | 0.40 - 0.70 | local calls | Free | golf dome/hr | 17.00 |
| | | public phone local call | 0.25 | golf club fee/yr | 1400 - 1700 |
| | | long distance/min. | | golf club | |
| 2 Alcohol (ALCB prices) | | Edmonton | 0.21 - 0.33 | share & initiation 000's | 15 - 20 |
| Wines /bottle | 6.00 - 12.00 | Toronto | 0.31 - 0.48 | recreation club | |
| Whiskies, rum, etc. | 18.00 - 30.00 | Frankfurt, 1st min. | 1.35 - 1.92 | share & initiation, 000's | 4.0 - 5.0 |
| | | additional/min | 0.90 - 1.28 | | |
| 3 Restaurants/bars | | Textbooks | | 10 Wages & Salaries | |
| Hamburger & wiener | 1.00 - 3.00 | U. of C. Bookstore | 35 - 250 | Minimum wage/hr | 5.0 |
| Breakfast | 4.00 - 9.00 | Book club | 25 - 40 | Labourer/hr | 8 - 14 |
| Dinner | 12.00 - 40.00 | Pocket books | 6 - 14 | Trades /hr | 18 - 24 |
| Coffee, tea/cup | 1.00 - 1.50 | Calgary Herald/yr | 147.00 | Engineer grad/rmth 00's | 25 - 32 |
| Aperitif/drink | 3.50 - 5.00 | weekdays/copy | 0.47 | Pharmacists /hr | 20 - 25 |
| Beer/glass | 1.25 - 1.50 | weekends/copy | 0.90 | Engineers/year 000's | 40 - 95 |
| | | Postage - Canadian | 0.43 | U. of C. academic salary | |
| 4 Apparel & shoes | | U.S. | 0.49 | scale floors, 000's | 30 - 60 |
| Suits | 250 - 600 | - Overseas | 0.86 | | |
| Trousers & slacks | 40 - 80 | Public library late | | 11 Service | |
| Shirts | 30 - 70 | return fine/day | 1.00 | Trades/hr | 35 - 80 |
| Skirts | 50 - 160 | | | Auto mechanic/hr | 55 - 80 |
| Dress shoes | 80 - 250 | 8 Transportation | | Appliance /Tv Repair/hr | 45 - 70 |
| Sports shoes & runners | 60 - 120 | Public Transit one way | 1.50 | Hair cut | 10 - 20 |
| | | Taxi-airport to U. of C. | 17 - 21 | Snow shovelling | 5 - 15 |
| 5 Accommodation & Shelter | | Bus - Calgary to Edm. | 30.00 | Professionals/hr | 180 - 250 |
| Hotel-single std./day | 75 - 150 | Air bus - Cal. to Edm. | 80 - 155 | | |
| Motel-single/day | 35 - 95 | | | | |

12 Other

| | | | | | |
|------------------------|-----------------|---------------------|-------------|-----------------------|-----------|
| Gold/ounce | US \$ 380 - 400 | box of kleenex | 1.00 | developing & printing | 15.00 |
| Tuition fees/yr | | toilet tissue/roll | 0.40 | reprints/print | 0.60 0.80 |
| U of C 000's | 1.2 - 1.5 | toothpaste/75 ml | 1.00 - 1.75 | Soap pack of 3 bars | 1.00 2.50 |
| L.S. colleges, 000's | 15 - 25 | toothbrush | 1.50 3.50 | Soft drinks/bottle | 0.75 1.00 |
| Household items | | Photography | | (coke, gingerale) | |
| aspirin (200 pills) | 8.00 | camera | 35 750 | Vitamins | |
| batteries, pack of 4AA | 4.00 | film | | multi (60 pills) | 5.50 |
| | | slide/24 exp. | 11.00 | C (200 pills) | 3.60 |
| | | color print/24 exp. | 4.50 - 5.00 | | |

TABLE L.1

| Consumer Price Index, CPI, Interest & Exchange Rate Data | | | | | | | |
|--|------------|----------------|------------------------|----------------------------------|-----------|-------------|----------------------|
| Year | CPI | Interest Rates | | Foreign Currency Exchange Rates† | | | |
| | 1986 Base* | Bank of Canada | Commercial Banks prime | US \$ | British £ | German D.M. | Japanese Yen (000's) |
| 1949 | 18.5 | | | | | | |
| 1950 | 19.0 | | | | | | |
| 1951 | 21.1 | | | 1.053 | 2.947 | 0.251 | |
| 1952 | 21.6 | | | 0.979 | 2.734 | 0.233 | 2.72 |
| 1953 | 21.4 | | | 0.983 | 2.767 | 0.234 | 2.73 |
| 1954 | 21.5 | | | 0.973 | 2.734 | 0.232 | 2.70 |
| 1955 | 21.5 | | | 0.986 | 2.754 | 0.234 | 2.74 |
| 1956 | 21.8 | 3.15 | 5.04 | 0.984 | 2.752 | 0.234 | 2.73 |
| 1957 | 22.5 | 4.02 | 5.58 | 0.959 | 2.679 | 0.228 | 2.66 |
| 1958 | 23.1 | 2.50 | 5.27 | 0.971 | 2.728 | 0.232 | 2.70 |
| 1959 | 23.4 | 5.13 | 5.65 | 0.959 | 2.694 | 0.230 | 2.66 |
| 1960 | 23.7 | 3.54 | 5.75 | 0.970 | 2.723 | 0.233 | 2.69 |
| 1961 | 23.9 | 3.06 | 5.60 | 1.013 | 2.839 | 0.252 | 2.81 |
| 1962 | 24.2 | 4.48 | 5.71 | 1.069 | 3.001 | 0.267 | 2.97 |
| 1963 | 24.6 | 3.88 | 5.75 | 1.079 | 3.020 | 0.271 | 3.00 |
| 1964 | 25.1 | 4.04 | 5.75 | 1.079 | 3.012 | 0.271 | 3.00 |
| 1965 | 25.7 | 4.29 | 5.77 | 1.078 | 3.014 | 0.270 | 3.00 |
| 1966 | 26.6 | 5.17 | 6.00 | 1.077 | 3.009 | 0.269 | 2.98 |
| 1967 | 27.6 | 4.98 | 5.92 | 1.079 | 2.962 | 0.271 | 2.98 |
| 1968 | 28.7 | 6.79 | 6.92 | 1.077 | 2.579 | 0.270 | 2.99 |
| 1969 | 30.0 | 7.46 | 7.96 | 1.077 | 2.574 | 0.275 | 3.01 |
| 1970 | 31.0 | 7.13 | 8.17 | 1.044 | 2.502 | 0.286 | 2.92 |
| 1971 | 31.9 | 5.19 | 6.48 | 1.010 | 2.469 | 0.291 | 2.91 |
| 1972 | 33.4 | 4.75 | 6.00 | 0.991 | 2.479 | 0.311 | 3.27 |
| 1973 | 36.0 | 6.13 | 7.65 | 1.000 | 2.452 | 0.378 | 3.70 |
| 1974 | 39.9 | 8.50 | 10.75 | 0.978 | 2.288 | 0.379 | 3.35 |
| 1975 | 44.2 | 8.50 | 9.42 | 1.017 | 2.259 | 0.414 | 3.43 |
| 1976 | 47.5 | 9.29 | 10.04 | 0.986 | 1.781 | 0.392 | 3.33 |
| 1977 | 51.3 | 7.71 | 8.50 | 1.063 | 1.857 | 0.459 | 3.98 |
| 1978 | 55.9 | 8.98 | 9.69 | 1.141 | 2.191 | 0.570 | 5.48 |
| 1979 | 61.0 | 12.10 | 12.90 | 1.171 | 2.486 | 0.640 | 5.37 |
| 1980 | 67.2 | 12.89 | 14.25 | 1.169 | 2.720 | 0.644 | 5.19 |
| 1981 | 75.5 | 17.93 | 19.29 | 1.199 | 2.430 | 0.532 | 5.45 |
| 1982 | 83.7 | 13.96 | 15.81 | 1.234 | 2.158 | 0.509 | 4.97 |
| 1983 | 88.5 | 9.55 | 11.17 | 1.232 | 1.869 | 0.483 | 5.19 |
| 1984 | 92.4 | 11.31 | 12.06 | 1.295 | 1.728 | 0.456 | 5.46 |
| 1985 | 96.0 | 9.65 | 10.58 | 1.366 | 1.771 | 0.468 | 5.77 |
| 1986 | 100.0 | 9.21 | 10.52 | 1.389 | 2.038 | 0.643 | 8.30 |
| 1987 | 104.4 | 8.40 | 9.52 | 1.326 | 2.173 | 0.739 | 9.19 |
| 1988 | 108.6 | 9.69 | 10.83 | 1.231 | 2.193 | 0.703 | 9.61 |
| 1989 | 114.0 | 12.29 | 13.33 | 1.184 | 1.941 | 0.631 | 8.60 |
| 1990 | 119.5 | 13.05 | 14.06 | 1.167 | 2.082 | 0.724 | 8.10 |
| 1991 | 126.2 | 9.03 | 9.94 | 1.146 | 2.028 | 0.694 | 8.53 |
| 1992 | 128.1 | 6.78 | 7.48 | 1.209 | 2.130 | 0.776 | 9.55 |

Courtesy Statistics Canada

* Previous Base/Reference years used by Statistics Canada are: 1937/38, 1949, 1961, 1971, 1981

† Canadian dollars per unit of foreign currency

APPENDIX M

FACULTY OF ENGINEERING OPERATING & CAPITAL BUDGET FIGURES

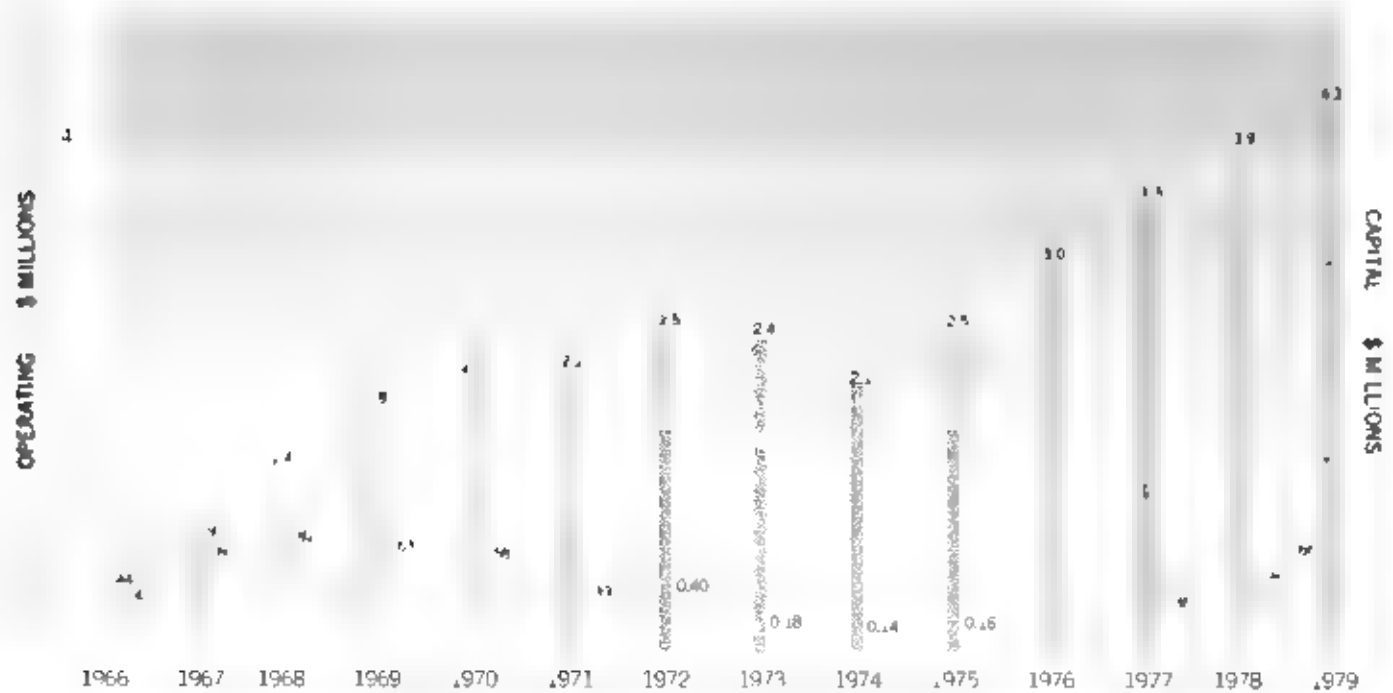


Fig. M 1 Total Operating and Capital Budget Figures for the Faculty, 1966-1979

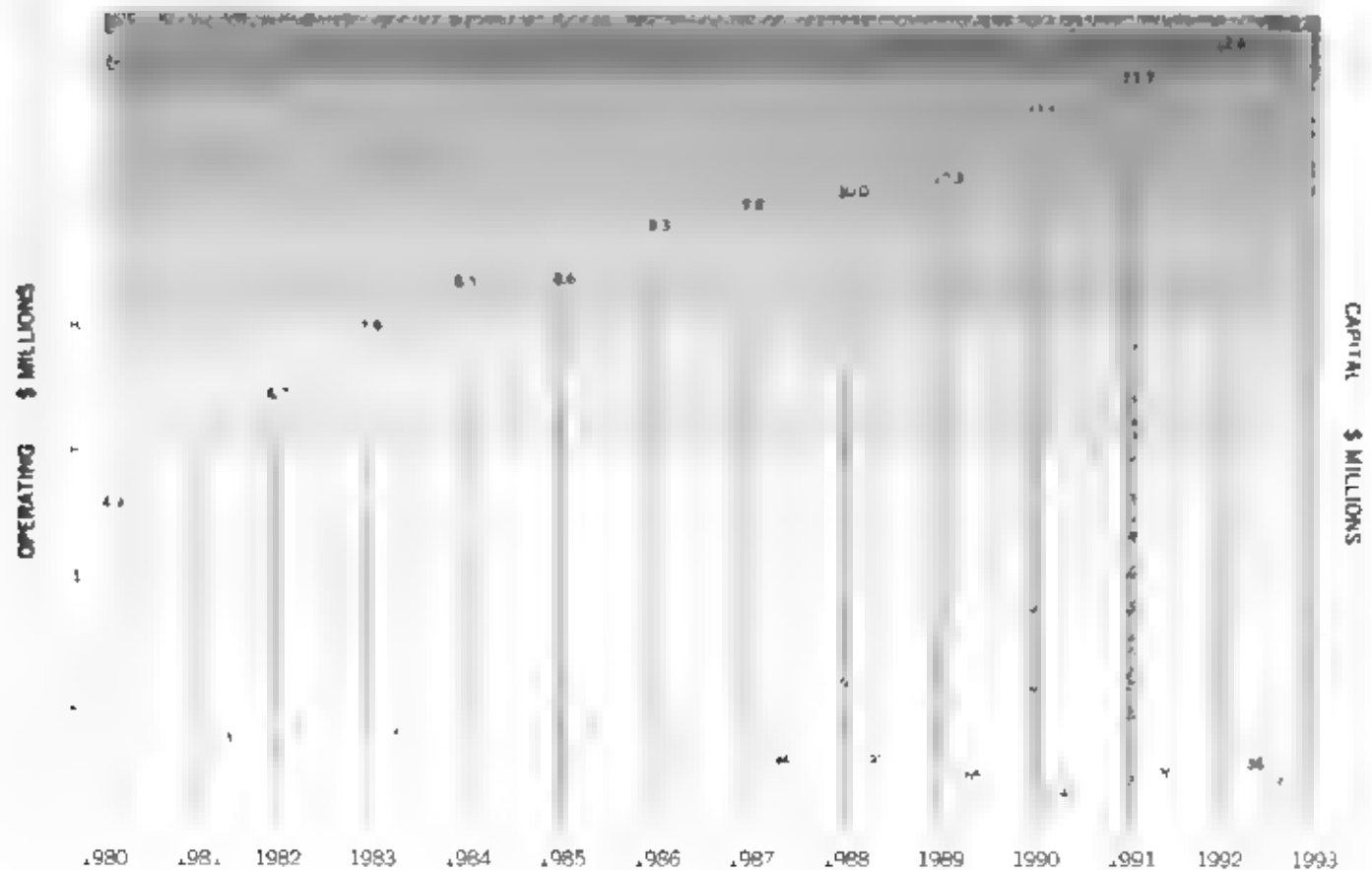


Fig. M 2 Total Operating and Capital Budget Figures for the Faculty, 1980-1993

CPI TABLE - CALGARY
1971 to 1993

| %
Change | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.000 | 1.043 | 1.069 | 1.100 | 1.114 | 1.085 | 1.085 | 1.082 | 1.087 | 1.104 | 1.133 | 1.120 | 1.046 | 1.025 | 1.029 | 1.035 | 1.038 | 1.027 | 1.039 | 1.062 | 1.060 | 1.014 | 1.013 | |
| 1971 | 1 | 1.043 | 1.115 | 1.226 | 1.366 | 1.482 | 1.608 | 1.740 | 1.892 | 2.068 | 2.366 | 2.650 | 2.769 | 2.839 | 2.921 | 3.023 | 3.138 | 3.223 | 3.345 | 3.553 | 3.768 | 3.819 | 3.868 |
| 1972 | 0.959 | 1 | 1.069 | 1.176 | 1.310 | 1.421 | 1.542 | 1.669 | 1.814 | 2.002 | 2.269 | 2.581 | 2.655 | 2.722 | 2.801 | 2.899 | 3.009 | 3.090 | 3.207 | 3.406 | 3.611 | 3.661 | 3.709 |
| 1973 | 0.897 | 0.935 | 1 | 1.100 | 1.225 | 1.330 | 1.443 | 1.561 | 1.697 | 1.873 | 2.122 | 2.377 | 2.484 | 2.546 | 2.620 | 2.711 | 2.815 | 2.891 | 3.000 | 3.186 | 3.376 | 3.425 | 3.468 |
| 1974 | 0.815 | 0.850 | 0.809 | 1 | 1.114 | 1.209 | 1.311 | 1.419 | 1.542 | 1.703 | 1.929 | 2.161 | 2.258 | 2.315 | 2.382 | 2.465 | 2.550 | 2.628 | 2.728 | 2.897 | 3.071 | 3.113 | 3.154 |
| 1975 | 0.732 | 0.763 | 0.816 | 0.896 | 1 | 1.085 | 1.177 | 1.274 | 1.385 | 1.529 | 1.732 | 1.940 | 2.027 | 2.078 | 2.138 | 2.213 | 2.297 | 2.359 | 2.448 | 2.600 | 2.756 | 2.795 | 2.831 |
| 1976 | 0.675 | 0.704 | 0.752 | 0.827 | 0.922 | 1 | 1.085 | 1.174 | 1.276 | 1.408 | 1.598 | 1.788 | 1.868 | 1.915 | 1.970 | 2.038 | 2.117 | 2.174 | 2.257 | 2.387 | 2.540 | 2.578 | 2.608 |
| 1977 | 0.622 | 0.648 | 0.693 | 0.763 | 0.849 | 0.922 | 1 | 1.082 | 1.176 | 1.298 | 1.471 | 1.640 | 1.722 | 1.765 | 1.816 | 1.880 | 1.951 | 2.004 | 2.080 | 2.209 | 2.361 | 2.374 | 2.405 |
| 1978 | 0.575 | 0.599 | 0.641 | 0.705 | 0.785 | 0.852 | 0.924 | 1 | 1.087 | 1.200 | 1.360 | 1.523 | 1.591 | 1.631 | 1.678 | 1.737 | 1.803 | 1.852 | 1.922 | 2.041 | 2.164 | 2.194 | 2.223 |
| 1979 | 0.529 | 0.551 | 0.589 | 0.648 | 0.722 | 0.784 | 0.850 | 0.926 | 1 | 1.104 | 1.251 | 1.401 | 1.464 | 1.501 | 1.544 | 1.598 | 1.659 | 1.704 | 1.768 | 1.878 | 1.991 | 2.019 | 2.045 |
| 1980 | 0.479 | 0.499 | 0.534 | 0.587 | 0.654 | 0.710 | 0.770 | 0.833 | 0.906 | 1 | 1.133 | 1.269 | 1.326 | 1.358 | 1.399 | 1.448 | 1.503 | 1.543 | 1.602 | 1.701 | 1.803 | 1.826 | 1.852 |
| 1981 | 0.423 | 0.441 | 0.471 | 0.5 | 0.577 | 0.626 | 0.680 | 0.735 | 0.799 | 0.883 | 1 | 1.120 | 1.170 | 1.200 | 1.234 | 1.278 | 1.326 | 1.362 | 1.414 | 1.501 | 1.592 | 1.614 | 1.625 |
| 1982 | 0.377 | 0.394 | 0.421 | 0.463 | 0.516 | 0.559 | 0.607 | 0.657 | 0.714 | 0.788 | 0.893 | 1 | 1.045 | 1.071 | 1.102 | 1.141 | 1.184 | 1.216 | 1.262 | 1.341 | 1.421 | 1.441 | 1.460 |
| 1983 | 0.361 | 0.377 | 0.403 | 0.443 | 0.493 | 0.535 | 0.581 | 0.628 | 0.683 | 0.754 | 0.854 | 0.957 | 1 | 1.025 | 1.055 | 1.092 | 1.133 | 1.164 | 1.208 | 1.283 | 1.360 | 1.379 | 1.397 |
| 1984 | 0.352 | 0.367 | 0.393 | 0.432 | 0.481 | 0.522 | 0.567 | 0.613 | 0.666 | 0.736 | 0.834 | 0.934 | 0.976 | 1 | 1.029 | 1.065 | 1.105 | 1.135 | 1.178 | 1.252 | 1.327 | 1.345 | 1.363 |
| 1985 | 0.342 | 0.357 | 0.382 | 0.420 | 0.468 | 0.508 | 0.551 | 0.596 | 0.648 | 0.715 | 0.810 | 0.907 | 0.948 | 0.972 | 1 | 1.035 | 1.074 | 1.103 | 1.145 | 1.216 | 1.289 | 1.307 | 1.324 |
| 1986 | 0.331 | 0.345 | 0.369 | 0.406 | 0.452 | 0.490 | 0.532 | 0.576 | 0.626 | 0.691 | 0.783 | 0.877 | 0.916 | 0.938 | 0.966 | 1 | 1.038 | 1.066 | 1.107 | 1.175 | 1.246 | 1.263 | 1.280 |
| 1987 | 0.3 | 0.322 | 0.355 | 0.39 | 0.435 | 0.472 | 0.513 | 0.555 | 0.603 | 0.666 | 0.754 | 0.845 | 0.883 | 0.905 | 0.931 | 0.963 | 1 | 1.027 | 1.066 | 1.132 | 1.200 | 1.27 | 1.233 |
| 1988 | 0.310 | 0.324 | 0.345 | 0.381 | 0.424 | 0.460 | 0.499 | 0.540 | 0.587 | 0.648 | 0.734 | 0.822 | 0.859 | 0.881 | 0.906 | 0.938 | 0.974 | 1 | 1.039 | 1.103 | 1.170 | 1.188 | 1.201 |
| 1989 | 0.299 | 0.312 | 0.333 | 0.367 | 0.408 | 0.443 | 0.481 | 0.520 | 0.565 | 0.624 | 0.707 | 0.792 | 0.828 | 0.849 | 0.873 | 0.904 | 0.936 | 0.963 | 1 | 1.062 | 1.126 | 1.14 | 1.156 |
| 1990 | 0.281 | 0.294 | 0.314 | 0.345 | 0.385 | 0.417 | 0.453 | 0.490 | 0.532 | 0.568 | 0.646 | 0.740 | 0.760 | 0.799 | 0.822 | 0.851 | 0.883 | 0.907 | 0.942 | 1 | 1.060 | 1.075 | 1.089 |
| 1991 | 0.266 | 0.277 | 0.296 | 0.326 | 0.363 | 0.394 | 0.427 | 0.462 | 0.502 | 0.555 | 0.628 | 0.704 | 0.735 | 0.754 | 0.776 | 0.803 | 0.833 | 0.856 | 0.888 | 0.943 | 1 | 1.014 | 1.027 |
| 1992 | 0.262 | 0.273 | 0.292 | 0.321 | 0.358 | 0.388 | 0.421 | 0.456 | 0.495 | 0.547 | 0.620 | 0.694 | 0.725 | 0.743 | 0.765 | 0.792 | 0.822 | 0.844 | 0.876 | 0.930 | 0.986 | 1 | 1.007 |
| 1993 | 0.259 | 0.270 | 0.288 | 0.317 | 0.353 | 0.383 | 0.416 | 0.450 | 0.489 | 0.540 | 0.612 | 0.685 | 0.716 | 0.734 | 0.755 | 0.782 | 0.811 | 0.833 | 0.865 | 0.918 | 0.974 | 0.987 | 1 |

Source: Statistics Canada, Catalogue No. 62-001

SOURCE: Statistics Canada, Calgary Office Alberta Treasury Bureau of Statistics "Alberta Statistical Review" Statistics Canada Catalogue 62-001

To Use the Table

- 1) Decide what year you want to use as a base. For example if you're interested in the relative purchasing power of one 1980 dollar at some time prior to or after 1980 then 1980 is your base year.
- 2) Locate the base year in the column down the left side of the table. Move to the right along the row of figures opposite until you come to the value "1" in the diagonal. That is your starting point.
- 3) If you want to convert your base year dollars to dollar amounts for some year in the future, move along the row to the right of your starting point until you intersect the column headed by your designated future year. The number you encounter is the dollar equivalent of one dollar in your base year. For example, one dollar in 1980 is equivalent in purchasing power to 1.544 dollars in 1988.
- 4) If you want to convert your base year dollars to dollar amounts for some year in the past, move left of the starting point. For example, one dollar in 1988 is equivalent in purchasing power to 34.5 cents in 1973.

Courtesy DIA

Table M 1 — Consumer Price index for Calgary — 1971-1993

APPENDIX N

LIST OF ENGINEERING GRADUANDS

1965

CIVIL ENGINEERING

| | | | |
|-----|--|---|----------------------------------|
| MSc | Adam, Michael Gordon
Bonn, Gordon Michael | Hitchings, Gordon Andrew
Rutledge, Stanley Edmonds | Staunton, Michael Martin William |
|-----|--|---|----------------------------------|

1966

CIVIL ENGINEERING

| | | | |
|-----|------------------------|----------------------------|--------------------|
| MSc | Hutton, Stanley George | Eikrem, Arnor Martin Aston | Guger, Harry Allan |
|-----|------------------------|----------------------------|--------------------|

1967

CIVIL ENGINEERING

| | | | | |
|-----|---|---|--|-----------------|
| PhD | Sheikh, Mohammed Akram | | | |
| MSc | Cook, David John
Guruswami, Ayakannu | Jessop, Emily Lewis
Jha, Prabhakar Chandra | Johnson, Gordon Alexander
Kwei, Gibson Chi-Shun | Sen, Anil Kumar |

MECHANICAL ENGINEERING

| | | | |
|-----|-------------------------|-------------------------|-------------------------|
| MSc | Kappel, Vlastimir Vilem | Krishnamurthy, Chityala | Yip, Francis King-Chuen |
|-----|-------------------------|-------------------------|-------------------------|

1968

CHEMICAL ENGINEERING

| | | |
|-----|------------------------|-----------------------|
| MSc | Colley, Donald Gilbert | Karra, Perayya Sastry |
|-----|------------------------|-----------------------|

CIVIL ENGINEERING

| | | | |
|-----|--|--|--|
| PhD | Gopalakrishnan, Killugudy S | | |
| MSc | Dawson, Robert Vincent
Goodrich, Norman Keith | Mullick, Ajay Kumar
Singh, Shivendra Prasad | Verma, Krishna Kumar
Zaghlool, Ezz El-Din Ramzy F |

ELECTRICAL ENGINEERING

| | | | |
|-----|------------------------|-----------------------|------------------------|
| MSc | De Sarkar, Asish Kumar | Griffith, Jimmy Meyer | Haslett, James William |
|-----|------------------------|-----------------------|------------------------|

MECHANICAL ENGINEERING

| | | | |
|-----|---------------------|-------------------------------|-----------------------|
| MSc | Bansil, Kulwant Rai | Krishnappen, Bommanna Gounder | Saha, Narayan Chandra |
|-----|---------------------|-------------------------------|-----------------------|

1969

CHEMICAL ENGINEERING

| | | |
|-----|--------------------------|--------------------|
| MSc | Dumani, Habibullah Ghazi | Frame, Grant Barry |
|-----|--------------------------|--------------------|

| | |
|-----|-------------|
| Dip | Martin, Ian |
|-----|-------------|

| | | | | |
|-----|--|--|--|--|
| BSc | Baux, William Allan
Biles, Douglas Everett Anthony
Brunner, Hans George
Carswell, Brian Allen
Dingle, Howard Brian
Gaetz, Alvin Keith | Harder, Ronald David
Haynes, Robert Byron
Holstead, Dan McKay
Hutton, Gerald Russel
Jossell, Clayton Emery
Jume, James Gordon | Manyluk, William Harold
Moller, Ole Per
Moynihan, Ronald George
Newman, Leonard James
Oliver, William Kent
Palmer, Cameron Ernest | Stephansson, Neil Allen
Strecker, William Frederick
Walks, John Paul Alexander |
|-----|--|--|--|--|

CIVIL ENGINEERING

| | | |
|-----|---|--|
| PhD | Cook, David John
Hepworth, Anthony John Wilton | Jessop, Emily Lewis
Shrivastava, Jagannath Prasad |
|-----|---|--|

| | | | |
|-------------|---|---|---|
| MSc | Bathe, Klaus-Jürgen
Cheung, Mo-Shing
Cooper, Maurice Byron | Hassan, Faisal Mohammed
Meschkat, Rainer
Morgan, Dudley Robert | Sood, Krishnan Kumar
Varma, Jitendra Prasad
Woodhead, Hubert Roger |
| D pl | Subramaniam, Thuryrajah | | |
| BSc | Arvidson, Wayne Douglas
Beugin, Brian Allan
Bower, Michael Richard
Butler, Larry Victor
Cahoon, James Alberta
Dempster, Donald Alexander | Falk, Trevor Ernest
Forbes, Gordon James
Fox, Leonard William
Geehan, Thomas Edward
Given, Patrick Wayne
Hancock, Richard Roland | Kerber, Reinhard Ernst
Lamb, Craig Harris
Lester, William Barry
McCracken, James William
Morasch, Loyde Hudson
Morin, Malcolm Bruce
Moulson, William James
Topley, Steven Bruce
Vancutsem, Klaas John |

ELECTRICAL ENGINEERING

| | | | |
|------------|--|---|---|
| MSc | Das, Pawan Kumar
Hayat, Syed Liaqat | McDermid, John Elliott
Pal, Ajay Kumar | |
| BSc | Agnew, David George
Alexandre, Eric Ernest
Bell, Douglas Hamilton
Berg, John Wayne
Blinston, Gordon Edwin
Botting, Ronald Clement
Card, John Douglas | Coldham, David Bruce
Collingwood, Barry Richard
Gibson, Alan James
Hubel, Dennis Wayne
Jarniczky, Laszlo Anthony F
Justin, Richard Warren
Lee, Sidney Grant | Loose, James Alfred
Manzer, Douglas Paul
Marrott, Charles Burns
Molyneaux, Richard Allison
Prater, Wallace Edwin
Robinson, David Richard Pelter
Smallwood, Robert Edward
Sparks, Frank Murray
Steeves, Kenneth Rodney
Tyler, Richard James |

MECHANICAL ENGINEERING

| | | | |
|-------------|--|---|--|
| PhD | Yip, Francis King-Chuen | | |
| MSc | Lam, Kwan Wu | Vaschita, Veer | |
| D pl | Lauckner, Dietrich Eckhart | | |
| BSc | Aitken, Donald John
Barrows, Terrence Russell
Ford, Robert Gordon
Hunt, Ronald Blaine
Last, Harry John | Leithhead, Thomas William
Lundvall, Barty Orville
Manery, William Robert
Munoz, Francis Sebastian Jacques
Nicholson, Murray Keith | Parkinson, James Michael
Pearson, Daniel William
Sabourin, Wyatt Paul
Sharp, Robert Bruce
Stanford, Michael Anthony
Thompson, Harold Richard
Wegmann, Helmut
Welsh, Gerry Wayne
Wheaton, Roland George |

1970

CHEMICAL ENGINEERING

| | | | |
|-------------|---|---|--|
| PhD | Holst, Peter Hans | | |
| MSc | Lamb, Arnold | | |
| MEng | Wichart, Edward | | |
| BSc | Abrey, John Lawrence
Adams, Ralph William
Cook, William Charles
Dieter, Eric Paul
Fisk, Ronald Robert | Hall, William David
Jackson, Donald Leslie
Jones, Bruce David
Leung, Thomas Bing-yiu
Low, James Kenneth | Malteotti, Ralph
Morrey-Jones, Christopher
Padula, Domenic
Ratte, Walter Ronald
Smedley, John Bruce Henry
van Hee, Gustaaf
Williams, John Ralph
Woo, Wing Yee |

CIVIL ENGINEERING

| | | | |
|-------------|--|---|---|
| PhD | Tadros, Gamal Sabri | Youssef, Wasfy | |
| MSc | Blood, Guy Wesley
Gerlach, Heinrich Otto Berthold
Kountouris, Christodoulos | Kruger, Dionyz Stephen
Letsch, Rainer Heinz
Mowat, Dallas Norman | Pritchard, Robert Geoffrey
Sisodiya, Rambhai Gangji
Skjoldingstad, Laurits
Sporn, Jan-Fredrich |
| MEng | Rodway, Lloyd Edward | | |
| BSc | Biswanger, Stephen Barry
Congdon, Robert Russell
Davies, Allan Turner
Dingle, Philip John
Empey, Donald Percival | Fraser, Barry John Alexander
Graham, James Douglas
Humber, Charles Allyn
McRae, George Douglas
Murrill, Allan William | Pagenkopf, Erhard Friedrich Karl
Sidebotham, Richard Stephen
Tilley, Ronald Gordon
Topping, James Stuart
van Bussel, Christiaan Wasil
van Gorp, Matthew Henry
vanderputten, Allen Graham
Wilton-Clark, Harry Michael |

ELECTRICAL ENGINEERING

| | | |
|------------|------------------------|------------------------|
| PhD | Babu, Chittinam Chitto | Haslett, James William |
|------------|------------------------|------------------------|

| | | | | |
|------------|---|--|---|---|
| MSc | Bryden, Brian Richard
E. Diwany, Mohamed Mahdy | Kar, Anil Kumar
Marriott, Charles Burns | Mikhael, Wasfy Boushra
Pederson, Roger Thomas | Tandon, Vithava Chandra |
| BSc | Bancroft, John Campbell
Brockway, Douglas Ronald
Brooks, Barry Wayne
Cervick, Ronald Richard | Fitzpatrick, Gordon James
Hemphill, Gavin Lee
Hill, Robert Morgan
Knudson, Dennis Keith | Nelson, Robert Kenneth
Plant, James Presswood
Rae, Robert George
Thomas, Brian William | Jinger, Clifford Donald
Wenger, Stanley Edward
Wouters, Beta Miklos |

MECHANICAL ENGINEERING

| | | | | |
|------------|---|---|--|--|
| PhD | Coulter, Donald Mervin | Ekrem, Arndt Kjørtan Astori | | |
| MSc | Dunlap, Thomas William
Khalil, Adham Mohamed | Mika, Karel
Sarpal, Gurcharan Singh | Tsang, Peter Wing Fai | |
| BSc | Barker, Donald Roy
Becker, Brian Arthur
Cole, Merion Lavern
Crist, William Louis
Cullen, Robert Costello
Doig, Lester George
Duncan, Grant John | Harrington, Brian George
Howes, Brian Charles
Jackson, Colin Philip
Lawrence, Gary Norman Lyle
Lowther, Bentley Ernest
Macdonald, George Ethelbert C.
Mah, William Min June | McLafferty, Marvin Neil
Matthiesen, Barbara Jean
Mullinger, Terrence Ray
Newmarch, Keith Edward
Oxloby, Allen Arthur
Perschon Jr, Fritz Hartmut
Plaeflin, Joachim Otto Friedrich | Rogers, Robert John
Schwindt, Keith Peter
van Schilt, Charles
Wilson, Robert Andrew |

1971

CHEMICAL ENGINEERING

| | | | | |
|------------|---|--|---|---|
| PhD | Whitfield, Geoffrey St. Quentin | | | |
| MSc | Agrawal, Shyam Sundar | Malpani, Setiya Narayan | Rao, Penumarti Narahari | |
| BSc | Anderson, William Frederick
Bergen, Kenneth Abe
Carr, Larry Alexander
Clark, Gillian Olwynne
Fay, John Elliot | Fischer, Charles Wayne
Gadomski, Sigmund
Hughes, Robert Merrel
Humphreys, Bryce Curtis
Jensen, Ole | Jones, Thomas E. B.
Jurkowski, Gary Frank
Lawrence, Terence Murray
Leung, Stephen Tung Yiu
Natland, John Philip | Nazarko, Taras Walter
Reid, David Albert
Sherley, Bruce Walter
Willson, Norman Douglas |

CIVIL ENGINEERING

| | | | | |
|--------------|--|---|--|---|
| PhD | Cheung, Mo-Shing | Smith, Robert Harry | Zaghlool, Ezz El-Din Ramzy F | |
| MSc | Abele, Guenther
Butler, Lawrence Victor
Harrison, Derrick George | Jagan, Brian Walter
Law, Tean Chee
LeMoai, Gerald Armand | Lester, William Barry
Matta, Samir George
Wang, Sue-Kai | |
| ME ng | Miller, Eldon Vernon | Werner, Marinus Pieter | | |
| BSc | Ainsworth, Jack Russell
Ash, Lloyd Leif
Beaton, Gavin Glen
Bourbonnie, Terrance Vincent
Buck, Bruce Warren
deVong, Bernard Leopold
De Laet, Bernard Joseph | Graham, David Ronald
Harrison, Gary Wayne
Hemstock, James Donald
Jeng, Tsong-Fu
Lee, Hon-Cheung
McDougall, Douglas Alec
McKellar, Malcolm James | Montgomery, Terry Alfred
Nakaska, Robert Joseph
Olsen, Harvey Edward
Phipps, Edward William
Polay, Robert George
Robertson, Raymond Francis
Sharp, Robert Thomas | Smith, Nigel John
Tanner, James Edward
Trowbridge, John Eric
Vennard, James Patrick
Wade, Christopher John
Wester, Cornelius Johannes
Wong, Yq-Ping |

ELECTRICAL ENGINEERING

| | | | | |
|------------|---|---|---|---|
| PhD | Walsh, John | | | |
| MSc | Bell, Douglas Hamilton
Dutta, Shiraj Robi Kumar | Elmetwally, Mahmoud Mohamed
Huber, Dennis Wayne | Jamniczky, Laszlo Antony Francis
Lee, Sidney Grant | Prater, Wallace Edwin
Smallwood, Robert Edward |
| BSc | Babulk, Thomas William
Barbrian, Eugene Ronald
Bobyk, Conrad Brant
Fenton, Terry Wayne
Ferris, Douglas John
Holmes, John Allan | Huestis, Edward Thomas
McClure, Derek
Olson, Grant Vernon Matthew
Owens, Gregory Kim
Pettersson, Arnold
Rabey, Noel Joslin | Ragan, Bill David
Reiter, Juergen Helmuth
Robson, John Russel
Rothbauer, Allen Ludwig
Schultz, James Edwin
Thompson, Thomas Ross | Toews, John Marvin
Toth, Terrence John
vanderlaag, J. Herman
Vielonsz, Dennis Valentine
Vostu, Jun
Zebrun, Fred Clarke |

MECHANICAL ENGINEERING

| | | | | |
|------------|---|-------------------------------------|---------------------------------------|--|
| PhD | Long, Bryan Russell | Meni, Narayanaswamy | | |
| MSc | Agbi, Babetunda Oisoghæde
Khosla, Anil | Kucera, Jiri
Latinovic, Vojislav | Seshadri, Rangaswamy
Wan, Wing-Kin | |

| | | | | |
|------------|--|--|---|--|
| BSc | Adams, Kenneth Charles
Allan, Richard Fairley
Barber, Howard James
Carter, Thomas Edward
Cornea, Peter E.
Danilowich, Michael Steven
Goddens, Richard Arthur | Griffiths, Gavin Elliott
Hannaford, Ronald Stennes
Harvey II, James H
Jiranek, Michael
Jozasse, Peter Adrian
Kercher, John Edward
MacGregor, Ian | Montgomery, William James
Morcom, Gary Lawrence
Nattrass, Mervyn Brent
Nicholls, Mark Andrew
Robinson, John Nathan
Rose, Dennis Norman
Stevens, Brian Albert John | Stewart, John Marshall
Sukoweff, Richard William
Swindells, Brian Kenneth
Tano, Yasuo
Toner, John James
van Dyk, Rudolph Pieter
Woody, Donald Eugene |
|------------|--|--|---|--|

1972

CHEMICAL ENGINEERING

| | | | | |
|-------------|--|--|--|--|
| PhD | Arrison, Norman Leroy | Auld, Robert George | Batycky, Jimmy Panko | Bradley, Keith James |
| MSc | Fraser, Kenneth Mackenzie
Kaneko, Takeshi
Kashyap, Arun Kumar | Kishnan, Thamra Ramakrishnan
Leung, Thomas Bing Yiu
Mandhane, Jamanlal Madanlal | Telford, Alan Stanford
van Hee, Gustaaf
Yu, Ching | |
| Dipl | Qureshi, Fayvaz Ahmad | | | |
| BSc | Anderson, Allister Brett
Azan, Khaleel Michael Jameel
Baerg, Gary Edwin
Ball, Daniel Ernest
Balog, Steven Edward | Bothner, Hugh Alvin
Bowns, Jaune Scott
Dobson, Gordon James
Gerus, Bruce Randall Dorn
Herring, Ian Wallace | Kana, Frank Jaroslav
Mah, Yook
McKay, Daryl Verne
Prestbakmo, Chester Allen
Reed, Marc Floyd | Seephure, John William
Taylor, James Michael
Thompson, Grant William
Trevitt, Richard Edwin |

CIVIL ENGINEERING

| | | | | |
|-------------|---|---|--|---|
| PhD | Bercha, Frank Gerald
Khalil, Souad Mahmoud
Khatua, Tara Pada | Mullick, Ajoy Kumar
Price, Patrick St John
Sisodiya, Rambhai Gangai | Skjoldingstad, Laurits
Tam, Chai Tim
Tawadros, Kamal Zaki | Vishwanath, Tekai |
| MSc | Coleman, Ronald Adrian
Khanlu, Magdi Mohamed Ahmad | Nelson, Seth Reed
Rust, Sydney John | Talkhai, Surindur Singh
Ulrich, Cecil Martin | |
| MEng | Timleck, Arthur James | | | |
| BSc | Ahlgren, Erik Lennart Rudolf
Allan, Peter Hastings
Chmilar, James Fredrick
D'Amour, Ronald Patrick
Eastgaard, Allan William | Gregg, James William
Hewitt, Richard Lytle
Holman, Johan Emiel Anton
Jensen, Chris Frederick
Johnson, Neil Howard | Kadonaga, John Akira
Langohr, Paul Heinz
Marasco, Gregory Francis
Meyer, Warren Gerald
Reger, Oscar Edward | Spring, Germaine Shella
Vale, Warren Lee
Vieaux, John Joseph
Walls, Terry Edward Harry |

ELECTRICAL ENGINEERING

| | | | | |
|-------------|---|---|---|---|
| PhD | Aly, Gamal Eldin Mohamed
De Sarkar, Asish Kumar | Hendon, Alan Gordon
Mukhopadhyay, Birmai Kanti | Sheirah, Mohamed Abdel-Hameed
Subramaniam, Pott | Treleven, David Henry |
| MSc | Brooks, Barry Wayne
Derynck, Ronald Richard | Dorrah, Hassan Taher Hasse
Kelly, Jon Michael | Omar, Abdel Rahman Abdel-Aziz
Runitz, Kenneth John | Schwartz, Rick Allen |
| MEng | Papp, Leslie Johnny | | | |
| BSc | Barnett, Brian Thomas
Blackadar, David Charles
de Champlain, Robert Louis
Dai, Dale Cameron
Detmold, John Murray
Gunn, William Stewart | Hedberg, Gordon Lewis
Janke, Wolfgang
Kozina, Mark Zlalko
Meadows, Stephen Albert
Mohr, Chris George
Pardiak, Joseph | Pearson, Larry Russell
Porter, Phillip Michael
Sandham, James Harry
Schultz, Brian Stewart
Shannon, Daniel John
Sparks, Warren Leigh | Steinback, John Kenneth
Tarchuk, Billy Brant
vaughan-Pope, Desmond Anthony
Wheatley, Dennis Maartell
Wight, James Stuart
Woo, Ray Ming |

MECHANICAL ENGINEERING

| | | | | |
|------------|---|---|--|---|
| PhD | Ali, Indar Abdul
O'Souza, Michael Vernon | Kappel, Vlastimir Villem
Khanna, Sardar Lal | Mohindra, Devendra Gian Singh | |
| MSc | El-Shoubashy, Mohamed Hanie
Howes, Brian Charles | Leithhead, Thomas William
Magapu, Vijay Kumar | Sayed-Aschraf, Hedayatoolah
Taylor, Murray Edgar | |
| BSc | Bates, Gavin Frank
Bieber, Robert Donald
Bielech, Robert Joseph
Bishop, Lynn Marvin
Brodbeck, Barry Allan
Brown, Merle Wayne
Burdyle, Leonard
Cheng, Teddy Tat
Clarke, Andrew Allan
Coates, James William
Cooney, Patrick Henry | De Boeck, Brian Richard
Dumka, Donald Neal Hubert
Ellithorpe, Richard Talwar
Frew, Craig Robert
Hambrook Jr, Barclay William
Hartzler, Curtis Avon
Johnson, Barry Colt
Keller, Wolfgang Elmar
Karl, David John Charles
Koch, Edwin Edward
Leonard, Raymond Alfred Frank | Longson, Douglas Bruce
MacAdam, James Murray
McCaffrey, Brian Joseph
Nagatomi, Toshiaki
Obal, Alvin Roy
Piea, John Elmer
Read, Michael Arthur
Redgwell, Brian James
Renton, Peter James
Robinson, Glen Frank
Sanden, Allan William | Slaysko, Robert Thomas
Thomas, Reid Herbert
Tsai, Vincent Juiwen
Tsutsumi, Shin
Jndershute, Lyle Grant
van Hardeveld, Thomas
Webb, Norman Brian
Winter, Darrel Patrick |

1973

CHEMICAL ENGINEERING

| | | | |
|-------------|--|---|--|
| PhD | Economopoulos, Alexander P
Lamb, Arnold | McLafferty, Frank George
Thussoo, Anil Krishan | Wenkoff, Michael Peter
Walls, John Paul Alexander |
| MSc | Brar, Gurneet Singh
Carr, Larry Alexander
Dingle, Howard Brian | Kuchendorf, Egbert
Leung, Stephen Tung Yiu
Mettar, Louis | Poon, David Chi Cheung
Winder, John Darrow
Vendrinsky, Dusan Anton |
| MEng | Millne, Kevin Carey | | |
| BSc | Blood, Donald James Norman
Bower, Richard Dale
Chen, Kenneth Gay
Chisholm, Daniel Thorpe
Coward, Robert Stanley
Craig, James Gordon | Damberger, Kenneth Raymond
Eng, Wayne Wong Yuhai
Harding, Thomas Grant
Healy, Paul Alexander
Holstein, Blaine Dale
Humphrys, George Ernest | Johnson, Carl Derald William
Lawrence, Edward Robert
Manyuk, Brian Frank
Morgan, David John
Phipps, Rodenckian
Quantz, Douglas Allan
Romanchuk, Kenneth Edwin
Sookram, George
Wahl, Edwin Leonard
Wells, Archie James
Wharton, Donald Charles
Yagos, Edward Stanley |

CIVIL ENGINEERING

| | | | |
|-------------|--|--|--|
| PhD | Daniel, Hans Rudi
Dawson, Robert Vincent | Malcolm, David John
Mee, Allen Louis | Rao, Vadaparty Jagannadha
Woodhead, Hubert Roger |
| MSc | Balgowan, William Leslie | Morasch, Loyde Hudson | Rizkalla, Fikry Ayad |
| MEng | Turner, William Campbell | | |
| BSc | Becker, Brian Howard
Berry, Robert Thomas
Bester, Martin James
Brander, Robert Bruce
Campbell, Thomas Lee
Clark, Terrance Matthew
Firth, Dennis George | Gold, Kohel
Gowing, Terrance Wayne
Heikoop, Martinus
Howard, William George
Jamieson, Douglas Alexander
Jansens, Karl
Knight, Allan Calvin | LeBihan, Hugo Gabriel
Lynch, Brian John
Mah, William
McNeely, James George
Pench, Frank Nicholas
Pilling, Dale Edward
Setters, John Michael
Shannon, Edward James
Stewart, Gordon Arthur
Stolz, Allan Peter
Sung, Raymond Men-Chan |

ELECTRICAL ENGINEERING

| | | | |
|------------|--|--|--|
| PhD | Altenhof, Terrence George | Dennis, Leslie Paul | Pederson, Roger Thomas |
| MSc | Abdel-Hakim, Makhloof Mohamed
Bancroft, John Campbell
El-Ghandaky, Adel Ahmed Mohamed | Freedman, Gordon Alexander
Haase, Armin Bernhard
Hemphill, Gavin Lee | Khadi, Abdel Aziz Mohamed
McClure, Derek
Pettersson, Arnold |
| BSc | Allred, Lorin Dehlin
Barrie, Kenneth Michael
Blair, David Macgregor
Cancar, Mustafa Kemal
Derynck, Paul Stuart Peter
Dnedger, Walker Cornelius
Edwards, Gordon James
Ermler, Roy Allen
Galvin, Stanley Joseph John | Henriksen, Mogens Korsgaard
Jacobsen, Steven Larry
Kiddle, Edward Roland
Langevin, John Arthur
Lee, David Kwong
Lefebvre, Jeanne Marie
Leuw, Jack Peter
Magnus, George Terrance
Mester, Louis Thomas | Milne, Ian Boland
Niemierzycki, Thaddeus Anthony
Otto, William Walter
Phillips, James Donald
Putnam, Kerry Robert
Rainsch, Brian Wayne
Robinson, Raymond Thomas
Rubrecht, Eckhard Kurt
Schulz, Franklin Terrance |

MECHANICAL ENGINEERING

| | | | |
|-------------|---|---|---|
| PhD | Ibrahim, Samir Rochoy | Settan, Antonin | |
| MSc | Danilowich, Michael Steven | Paul, Raju Vengasseri | |
| MEng | Kumar, Kaup Sanjiva Vinod | Tims, Herbert | |
| BSc | Adams, James Wayne
Boulton, Brian Donald
Bowersock, Charles Bruce
Bustin, David Paul Ernest
Chan, Chi Fu Michael
Crawford, John Robert
Devalerola, Stanley Earl
Dorschner, Elvin Deloy
Eubank, John Rea Stewart
Evelin, Reinhart Adriaan Frederick | Frank, John William
Freeborn, William Randall
Hager, Marvin William
Hval, Brian Harold
Jeffers, Harold Randy
Johnston, Ronald Barry
Kovacs, John Richard
Leung, Ronnie Kuan-Yu
Matzalla, Patrick Michael
Moe, Donald Gregory | Newman, Donald Keith
Pasnak, John Maurice
Patterson, Murray Gilbert
Pilling, Richard William
Root, Donald William
Ross, Gordon William
Russell, Gary Lynn
Sander, James Clifford
Sandford, Donald Spence
Snyder, Darvi Wayne
Stewart, Dan McGregor
Stinger, Dennis Robert
Stuart, David John
Sundgaard, Dennis Hugh
Thompson, Daniel Henry
Thompson, Stanley Paul
Urdai, Darcy Neil
Wilson, James Christiaan |

1974

CHEMICAL ENGINEERING

| | | | |
|------------|--|--|--|
| PhD | Gupta, Yash Pal | | |
| MSc | Agarwal, Suresh Chandra | Younas, Muhammad | Zaidi, Syed Muhammad Abbas |
| BSc | Cox, David Howard
Davis, Brian William
Estep, Robert Edward
Fulton, Dennis James
Gomke, Terry William
Graham, Paul Norman | Innes, Douglas Muir
Jackson, Steven Barry
Jang, Chuck
Kannett, Richard Douglas
Ko, Stephen Chi-Ming
Koncinski, Katherine Anne | Kopp, Stanley Peter
Maenica, Miro Peter
McLeod, John Alexander
McNichol, Peter Alexander
Mock, Timothy Charles
Nicoud, Richard August
Peña, David Stafford
Saedi, Mohamed Reza
Soo, Edmond
Varty, Ean Leroy
Way, Richard William
Wong, Raymond Kam Foon |

CIVIL ENGINEERING

| | | | |
|-------------|--|--|--|
| PhD | Brown, Thomas Girvan | Salinas-Pacheco, Juan Jose | Smith, Gordon James |
| MSc | Aki, Fathy Abou Zakry Ahmed
Day, Robert Leonard | Elkamshoshy, Fathy Mohamed
Finn, Nicholas | Jangohr, Paul Heinz
Werner, Alexander |
| MEng | Keith, Robert James | | |
| BSc | Brown, John Cameron
Carter, Dwight John Eford
Daniel, Anton Christoph
Davis, Brett Randall
Faminow, Paul Joseph
Friesen, Colin Eric | Grifford, Peter Marston
Haigh, Terrence Richard
Hamas, Mark William
Hellard, David Gerald
Hill, Lawrence Wray
Hrouda, Jan | Kercher, Gerald Albert
Koch, Verlin Harold
Lakeman, Alexander
Lee, Thomas Manchun
McNally, Patrick Hugh
Recky, Keith Alexander
Risler, Ernest Gary
Scarborough, Charles Morton J.
Scott, Andrew John
Wohlers, Charles Henry |

ELECTRICAL ENGINEERING

| | | | | |
|------------|---|---|---|--|
| PhD | Elmetwally, Mahmoud Mohamed | Huber, Dennis Wayne | Jain, Mahendra Kumar | Rasmy, Mohamed Emad Mousa |
| MSc | Tadros, Lorees Badie Metry | | | |
| BSc | Atkins, Robert Carlyle
Bruch, Michael John
Dickin, John Gordon
Hager, David Grant
Hamilton, Cameron Stuart
Jacobs, Gavin Byron Shane
Jestin, Edward James | Kadonaga, Wesley
Kiesling, Friedrich Robert
Knapp, Paul Lawrence
Krausas, Anvydas
Krenz, Erhard
Kusinski, Melvin | Layson, Daniel Peter John
Jimoges, Eugene Joseph
Myroon, Kenneth Alexander
Nakaska, John Dennis
Page, Brian Edward
Reid, Douglas John Robert | Ruud, Robert Leroy
Snowdon, Reginald Gordon
Stackhouse, Darryl Keith
Triffo, Dale Alexander
Turner, Laurence Edmund
Yu, Chi Kin |

MECHANICAL ENGINEERING

| | | | | |
|------------|---|--|---|--|
| PhD | Dang, Quy Duc
Khosla, Anil | Marzouk, El-Sayed Mohamed
Mishra, Arun Kumar | Sarpal, Gurcharan Singh
Seshadri, Rangaswamy | Tsang, Peter Wing Fai |
| MSc | Aziz, Aziz Attia
Balasubramanian, Ramakrishnan | Cullen, Robert Costello
Khare, Jitendra Mai | Rane, Manohar Tryambak
van Hardeveld, Thomas | |
| BSc | Abel, Richard Arthur
Barnes, John Grenville
Baugh, John Russell
Bing, Terry Leo
Bird, Brian Charles
Buchanan, Brian Neil
Campbell, Hector Douglas
Collins, Scot R.
Deyell, Michael John | Driscoll, Brian Laurence
Frey, Arthur Patrick
Gale, James George
Grønnerud, Glenn Thomas
Hult, Verne Arthur
Ibbotson, Donald John
Kinniburgh, Ronald Bruce
Koddo, Alexey
Lee, Fook Yum | Juplak, Andre Dusan
MacKenzie, Douglas Hubert
McGuffin, Robert Gordon
Miller, William James
Mustard, Robert Wayne
Osadchuk, Richard Samuel
Quon, George
Roth, Douglas Rodney
Snider, Philip Lee | Togstad, Frank Andrew
Tser, David Arnold
van Der Straeten, William Charles
vanderputten, Ross Wayne
Way, Dennis Keith
Westgate, William Blair
Yanota, Thomas Stephen
Yee, Chester Wayne |

1975

CHEMICAL ENGINEERING

| | | | |
|-------------|--|---|---|
| MSc | Greenstade, John Gary | Farmer, Balbir Singh | Yu, Richard Kwok F. in |
| MEng | Lock, Robert Graham | | |
| BSc | Anderson, Donald Bruce
Bell, Robert Gordon
Carlson, Patrick Beverley
Cheung, Wing-Chuen
Darby, James Victor
Dibble, Neil Charles
Earl, Larry Wayne | Falk, Richard Bruce
Fukumoto, Wayne Michael
Fuller, Gerald Gendall
Fung, Kan-Tong Bernard
Heinrichs, Neil Barry
Kamen, Randall Lee | Lampert, Leonard Frederick
McWilliams, James Patrick
Padula, Mario
Rafa, Kenneth Gerard
Reimer, Timothy John
Rousch, Wayne John
Schultz, Richard Allyn
Shand, Brian Douglas
Smith, Richard Allen Wayne
Stephens, David Kent
Swenson, Rodney Walter
Wong, Wan-Sau Stephen |

CIVIL ENGINEERING

| | | | | |
|------------|---|---|--|---|
| PhD | Tadros, Maher Khalil | | | |
| MSc | Cameron, Neville Stanley | Ghoneim, Ghoneim Abdel-Aziz M | Khalil, Nagwa Abd El-Gendi | |
| BSc | Arneson, Edward Louis
Grant, David Frederick
Griffiths, David Edwin
Harder, Ronald Edwin
Higgins, Charles William | Hoenderkamp, Johannes C D
Houston, Marion
Jewitt, William James
Kellam, Ronald George
Lamb, Garry Alexander | Laustsen, Kenneth Daryl
McGuire, Terrence Martin
Nakatsui, Alan Noboru
Ramsey, Neil
Schnitzer, Joseph John | Skeet, James Allen
Straw, Phillip Jeffery
To, Leung-Wy
Trevitt, Lindsay Bruce
Wong, Don Chung-Siu |

ELECTRICAL ENGINEERING

| | | | | |
|-------------|---|--|---|---|
| PhD | Dorrah, Hassen Taher Hassen | Farag, Ahmed Sobhy Aiy | Scholz, Frank Joseph | |
| MSc | Kepariwal, Murari Lal | | | |
| MEng | Tarchuk, Billy Brant | | | |
| BSc | Barnett, Kerry Brian Fox
Berry, Douglas James
Coffin, Russell Colin
Cross, Wayne Ronald
Der, Charles York-Chew
Dingle, Robert John
Dobson, John Craig Warwick | Gauthier, Charles Eugene
Hawkins, David Lyle
Hedayat, Adham Gamal
Hudzi, Allan Michael
Janzen, Frank
Kay, William Jacob
Kovatch, Reginald Paul | Lee, Jim Pak Yee
Leung, Davy Kai-Hon
Lok, William Yuen Kwan
Mak, Daniel King Yan
McKenzie, Gary Wayne
Paquet, Jean-Louis Joseph
Palram, Henry | Plumppre, Frank Philip Alexander
Podmaroff, David Eugene
Sherman, Perry William
Smith, Martin David Lawrence
Standish, Wayne Phillip
Staroszek, Wayne Douglas
Talbot, Paul Reginald |

MECHANICAL ENGINEERING

| | | | | |
|-------------|---|--|---|--|
| PhD | El-Shoubashy, Mohamed Hanie | | | |
| MSc | Singh, Mahendra | To, Cho Wing Solomon | | |
| Dipl | Mansour, Nabil Tawfiq Lutf | | | |
| BSc | Ahmad, Abdul Aziz Bin
Allardice, Brent Joseph
Bagnall, Patrick Herbert
Cartwright, George Alexander
Chan, Patrick Wa-Shun
Chan, Samuel Y W
Cheng, Kwai Ming | Clark, Roy Stanley
Fes, Paul Tin-Fook
Hay, Gregory Thomas
Janz, Victor Paul
Jones, Donald Edward Habberley
Law, Kenneth Sheek-Kin
MacInnes, Douglas Blaine | Muhamad, Othman Bin
Mui, Marilyn Bryce
Nicholson, Robert Armstrong
Olson, Christian Harvey
Ronellenlitch, Barry Conrad
Szpecht, John Michael
Woldum, Kenneth John | Wong, Frank
Woo, David Gee Sheung
Wulf, Manfred
Yurchewich, John David Peter
Zacher, Brian Jacob |

1976

CHEMICAL ENGINEERING

| | | | | |
|-------------|---|---|---|--|
| PhD | Soremi, Adeyinka | | | |
| MSc | Evelerin, Katherine Anne | Harding, Thomas Grant | Kalir, Chowdhury Shahjahan | Singh, Jagjit |
| MEng | Burger, David Harold | Stright, Daniel Halbert | | |
| BSc | Barber, David Raymond
Bateman, Wayne Stanley
Campbell, John Michael
Camick, Gordon Joseph
Chiu, Shun-Wing Wayne
Clark, Robert Blaine | Copeland, Donald Darrell
Dacanay Jr, Gregorio Guerrero
De Bruyn, Roland Peter
Fidercke, Juergen
Grier, Roy Vincent
Hanlon, Gregory Charles Francis | Hemstock, John Alexander
Hughes, Terrance Malcolm
Kraychy, Anton Nickolas
Kuran, Gregory Joseph
Lee, See Min Alfred
Leon, Richard Luis | Long, Douglas Howard
Moynihan, Terence Joseph
Scarpino, Angelo
Sze, Joseph Tak Suen |

CIVIL ENGINEERING

| | | | | |
|-------------|--|--|--|--|
| PhD | Badawy, Hammouda El-Sayed | Khalifa, Magdi Mohamed Ahmed | | |
| MSc | Barakat, Mohamad Ay Abdel-Salam
Cherian, Varghese | Elsawy, Abdel-Fattah Mohamed Y
Hemstock, James Donald | Stanley, Roger Graham
Tung, Garman | |
| MEng | Culham, Gerald Andrew | | | |
| Dipl | Ali, Syed Nusrat | | | |
| BSc | Broda, Alexander Peter
Bushnag, Sam S
Byers, Michael Alan
Carter, Rodney George
Chan, Timothy Ping-Kwan
Clark, Glen Alan
Connolly, Brian David | Davis, John Herbert
Dickson, John Michael
Enslin, Peter Michael
Hawk, Hugh Raymond
Ho, Lawrence
Huang, Orlando Yuan-Ti
Kellin, Kim Christopher | Klaver, Charles Cornelius
Lee, Jerry Sherman
Marsden, Gordon William
McIntosh, Brian Lloyd
McNeely, James Bryce
Middleton, Geoffrey Mark
Monson, Graham Melville | Muir, Donald Leigh
Nakaska, Alan Gustav
Novak, Glen Joseph
Ontko, James Michael
Proznjak, Jozef Stanley
Whyte, William Donald |

ELECTRICAL ENGINEERING

| | | | | |
|-----|---|--|---|---|
| PhD | El-Ghandaky, Adel Ahmed Mohamed | Haase, Armin Bernhard | Mao, Ding-Yenn | Vaughan-Pope, Desmond Anthony |
| MSc | Arunachalam, Vaidhyanathan | Dodd, Cecil Lavem | D'Sa, Alwyn Patrick | |
| BSc | Bartley, Norman Robertson
Biagioni, Gary Samuel
Bourne, Donald Arthur
Brache, Serge David Hubert
Djurkin, Ivan Joseph
Driscoll, Timothy Sean | Fayeski, Erik Stephen
Hrskovich, Brian Robert James
Imorde, Dettler
James, Jeremy Paul
Jenke, Alan Max
Lee, Albert Wai-Kuen | Jewellin, Lawrence Douglas
Martinuk, John Robert
Miller, David Richard Craig
O'Brien, Kevin Taylor
Pascu, Patrick Peter
Peters, Randall Arthur | Pytlarz, Brian Martin
Sexsmith, Gary James
Slamka, Milan
Sloot, James William
Wilson, Donald Gordon |

MECHANICAL ENGINEERING

| | | | | |
|-----|---|---|---|--|
| PhD | Rehman, Mubeenool | | | |
| MSc | Kumar, Rishi | Lee, Fook-Yum | Leung, Ron Kuan-Yu | |
| BSc | Bader, Arthur
Carvelth, Donald James
Christiansen, Soran
Conrad, Harold Arthur
Coutlis, John Armstrong
Elfer, Paul Harris
Fischer, Glen Charles | Fleming, Mervin Roy
Homady, William Thomas
Kars, John
Kwan, Do Wah Tony
Laertini, Carlo Alberto
Lam, Kelvin Kwan-Hung
Lee, Tom Sea-Howm | Louie, Donald
Ma, Eddie Ding-Cheong
Mercler, Daniel Anthony
Metcalf, Gary Donald
Proc, James Steven Mark
Rojek, Ota
Rowe, William Henry | Smit, Dirk
Spencer, Arthur Gerald
Sukovjeff, Raymond Leonard
Thirsk, Robert Brent
Trentham, Alan Harry
Tullissi, George |

1977

CHEMICAL ENGINEERING

| | | | | |
|------|---|--|---|---|
| MSc | Astete, Ernesto Leonardo
Blakemore, Frederick Brian | Coskun, Izzet
Ito, Yoshiaki | Ko, Stephen Chi Ming
Mathews, Abraham | Shah, Mukesh Kantilal |
| MEng | Robinson, John Nathan | Stevens, Brian Albert John | | |
| DipI | Seymour, James David | Woo, Ying Yee | | |
| BSc | Chan, Albert Wing-Gun
Chmiller, David William
Chung, Kam Ping Peter
Crombie, David Lennox
Hamilton, Laura Grace
Hojnik, Alan Christopher | Kelly, Neil Colin
LaBerge, Colin Lokken
Law, Denny Sei Kiu
Lu, Dennis Kin Leung
MacLeod, William Arthur
Mathur, Anita | McComack, Michael Edwin
Morrison, Douglas Clark
Oliphant, David Thomas
Parsons, Robert Vaughan
Rispler, Keith Alan
Sardinha, David Anthony | Siegle, Floyd Eric
Twygge, Allan Thomas
Walker, Lyle Douglas
Way, William Patrick
Wilson, James Randall
Yamanouchi, Koji |

CIVIL ENGINEERING

| | | | | |
|------|---|--|---|---|
| PhD | Khalil, Amir Bayoumy Ibrahim | Neth, Volker Wolfgang | | |
| MSc | Andrae, Hans-Peter Wolfhart
Cook, Geoffrey Herbert | Gifford, Peter Marston
Haspel, Raimund Anton | Perich, Frank Nicholas
Raghupatruni, Satyanarayana Rao | Woodall, David Charles
Zemp, Robert Walker |
| MEng | Bolger, Daniel
Daskalchuk, Edwin William | Gray, Alan James
Johnson, Rolf Wilhelm | Olsen, Harvey Edward | |
| BSc | Atkins, Dianne Marie
Barnoff, Usher Allan
Best, Richard Paul
Buchanan, Guy Donald
Buckland, Donald Richard
Carlson, John Douglas
Chalmers, Donald Gordon
Chan, Ching Kam Alan
Chan, Francis Kam-Mon | Chromy, Steven John
Clark, Robert Frank Eustace
Degecker, John Teunis
Dielwart, John Patrick
Gernish, Russell Edward Turville
Goss, Bradley Wayne
Graham, David Peter
Hargrave, William Ralph
Hasham, Salim Badrudin | Hq, Fui Yen
Holden, Gordon
Holicky, John James
Howard, Bruce Almer
Kurczaba, Ronald Michael
Kwan, Wing Keung
Lee, Joseph Jin
Lo, Yuk Ming Rick
Lui, Darwin Laurie | Maloff, Frederick Peter
McCready, Michael John
Ng, Eric Tze Tak
Tsu, Chin Kee
Tromposch, Joachim Ernest
van der Voet, Adnan Frank
Wong, Martin Sung-Kim
Yeung, Chi-Wai Kenny |

ELECTRICAL ENGINEERING

| | | | | |
|-----|---|--|---|--|
| PhD | Abouelwafa, Maged Abdelhalim
Coldham, David Bruce | Khadr, Abdel-Aziz Mohamed
Mamandur, Rangiah Chetty | Ramamoorthy, Panapakkam A | |
| MSc | Hall, Michael Anthony | Mansour, Yekout Mansour Y | Ramanujam, Rangarajan | Vasudevan, Rangaswamy |
| BSc | Anson, Douglas William
Best, Wayne Bruce
Cassidy, Bernie James
Dakin, Allan Leslie | Huang, Tien Chein
Hultema, George Theodore
Keating, James Ross
Palmer, John Miram | Poscente, Sandro Priamo
Sharman, Duane Robert
Smith, Neil Duncan
Tsang, Yeung-Kwan | Whyte, Margaret Joanne
Wong, David Wei-Man
Wong, Ho-Man
Wong, Simon Shui-Ngai |

MECHANICAL ENGINEERING

| | | | | |
|------------|--|--|---|---|
| MSc | Burn, Karam Singh | Gabriel, Joseph | Read, Michael Arthur | Samra, Gurbachan Singh |
| BSc | Adhami, Mohammad Waseem
Baden, Gregory Allan
Bruiners, Gabe John
Buchanan, Gianni Bryan
Chan, Mark Yuk Sum
Chow, Wayne Woo
Christensen, Murray Keith
Clark, Douglas Alan
Connors, Terrell Beldon | Cronshaw, Thor James
Dyck, Donald Wesley
Fauvel, Owen Roderick
Gainer, James Campbell
Hodgkinson, Raymond John
Honey, James Gibson
Klaver, Heye Henry
Lai, Desmond Yuen Shing
Lau, Larry Hoi-Kun | Laustsen, Dana Bruce
Lebel, Jean Pierre
Martens, Peter
Mathew, Jacob
O'Brien, Colin Dean
Poon, Yiu-Tong
Quinn, Gerald David
Schlichter, Henry George
Schulz, Detlef Gerhard | Sick, Douglas Carl
Sikorski, David Anthony
Soon, Phillip Roy
Swan, Patricia Lynn
Therault, Robert Joseph
Whiteley, Geoffrey Sean |

1978

CHEMICAL ENGINEERING

| | | | | |
|-------------|--|---|--|--|
| PhD | Hayashilani, Masao | | | |
| MSc | Abdalla, Elhassan Omer
Di Capua, Maria Enriqueta | Ejogu, Godwin Chukwemeka
Jacobs, Franciscus Adrianus P | Osman, Mohammed El-Sayed | |
| MEng | Tse, Samuel Yuet-Hung | | | |
| DipI | Louie, James Gordon | | | |
| BSc | Annamanthadoo, Aditya Velmik
Bailey, Robert Bruce
Bogart, Garth Warren
Campbell, Bruce Munroe
Chan, Wai-Fong Bernadette
Chan, Wang Kay Cogburn
Ching, Edmond Kam-Sun | Chornoboy, Gregory Maurice
Christensen, David Richard
Dole, Stephen Arnold
Hill, Jennifer Louise
Howell, William Neil
Jarrett, Larry Keith
Jones, Peter Wayne | Kohse, Gordon Edward
Leung, Philip Chi-Chung
Macdonald, Robert Graeme
Martin, Raymond John
Mayers, Andrew Francis
Ng, Kwok-Wing
Palmer, Doug William | Purcell, Douglas Ronald
Roman, Kenneth James
Shibley, Jihad Adeeb
Sider, Peter Andrew
Smink, Astrid Margarethe
Stavura, John Alexander
Yung, Peter Sailing |

CIVIL ENGINEERING

| | | | | |
|-------------|---|--|--|--|
| PhD | Ghoneim, Ghoneim Abdel-Aziz M | Talha, Medhat Ahmed | | |
| MSc | Brander, Robert Bruce
Daniel, Anton Christoph | Ghoneim, Nadia Sobhi Abdel-Nour
Hawk, Hugh Raymond | Hon, Shiu Ping
Khalil, Dewiat Abuefotookh | Seble, Frieder
Wang, Teen-Ching |
| MEng | Hancock, Richard Roland | | | |
| BSc | Badun, Robert Donald
Bell, John Randal
Bennett, George Christopher
Berg, Kent Joseph
Berry, Donald Wesley
Bonesky, Neil Richard
Burnett, Kent Russell
Carter-Edwards, Stephen
Chan, Richard Chiu-Fong
Chan, Ricky Kam Wing
Chan, Wing-Dok
Chiu, Ho Yin
Choi, Eddie Sing Chuen | Costello, Hugh Staver
Dermitt, Anast
Dickson, Rennie John
Dixon, Alan James
Flower, Kenneth Douglas
Frick, Stefan
Genest, Daniel Robin
Helwerda, Harry Jan
Hildenbrandt, Robert Peter
Ho, Herbert Hok-Bun
Hung, Sok Ming
King, Donald
Kwas, Bobby John | Kwok, Lai-Him Frankie
Lai, Patrick Siu Wai
Lam, Hing-Keung William
Leong, Peter John
Leseberg, George Peter
Jung, Siu-Tsang
Matsuyama, Dean Lyle
Matthews, David John
Michalak, Thomas John
Ng, Tak Kwan
Olson, Timothy Craig
Pearson, Jeffrey John
Pesta, Thomas Joseph | Rempe, Ronald Ulrich
Roth, Norman Albert
Sartorelli, Anthony Neil
Supangat, Nanang
Taylor, Monte
Tersmette, Walter Clemens
Vogt, Ross Philip
Wang, Yu-Jen Jonei
Yuen, Bun Chuen Benedict
Yuen, Callistus Cho-Tak
Zwick, Edward Lukas |

ELECTRICAL ENGINEERING

| | | | | |
|-------------|---|---|---|--|
| PhD | Maklad, Maher Sorour | | | |
| MSc | Atkins, Robert Carlyle
Babey, Stephen Kent | Bartley, Norman Robertson
James, Jeremy Paul | Rao, Madana Krishna Narendra
Rodrigues, Frederick Ignatius | Sherah, Magda Mostafa Mohamed M |
| DipI | Szkora, Joseph Maxwell | | | |
| BSc | Badry, Robert Allen
Bannon, Gerald Lester
Briere, Denis Joseph
Chiu, Edmund Sung Kwong
Densmore, David Alan
Dyck, Markam Peter | Helfmann, Claus Juergen
Hickie, David John
Houston, James Thomas
Johansen, Henrik
Johnston, James Wesley
Lee, Joseph Yiu Fai | MacKay, Craig Anderson
Magniey, Ronald James
Nakaska, David Matthew
Ratzlaff, Douglas Lloyd
Rhebergen, Gilbert Frank
Rutkunas, Anthony Stanley | Sharman, Keith Philip
Shaw, Gregory Ridley
To, Shun Wei Anthony
Wong, Washun Wilson
Zwierchowski, Stanley John |

MECHANICAL ENGINEERING

| | | | |
|------------|----------------------------|---------------------------------|----------------------------|
| PhD | Badi, Osama Ahmed Mohammed | Bardon, Michael Fredric Richard | Metwally, Metwally Mohamed |
| MSc | Mehra, Meenaksh Kumar | | |

MEng Jones, William Gretton Owen, Howard Douglas

Dipl Hoogensen, Christiaan Pieter

BSc Chan, Chung Wai
Chen, Gordon
Chow, Stuart Yiu
Colvin, Kenneth Leslie
Connolly, Gary William
Davidson, John Clark
Duncan, William Ian
Guest, Frederick Crandell
Harrison, Gary Bruce
Hui, James Kam-Cheong
John, William Brock

Kercher, Donald Wayne
Kim, Eui-Boo
Larson, Brian Michael
Lau, Stephen Chan-Kin
Lyndon, Michael William
MacDonald, Ron Richard
Martynkiw, Włodysmyr Josef
Ness, Larry Arnold
Osterling, Michael
Pedersen, Paul Vespig
Phong, Kam Keong

Rogers, David Frederick
Schramm, Robert Edward
Sittler, Alan Joseph
Siu, Lung-Wai
Skorayko, Fraser
Stobart, William Link
Stobo, Barry John
Stokes, David Charles
Svarich, Terrance Donald
Therigaard, Michael
Tse, Jason Kaichun

van Dijk Jr, Alexander Anthony
vandenbrink, Stephen Roy
Wagner, William Leon
Weilmon, James Herbert
Wong, Chun Sang Joseph
Wong, Emil Chung Lau
Wong, Lawrence Wing-Chun
Yau, Paul Tak-Wah
Yiu, Hai Man

1979

CHEMICAL ENGINEERING

MSc Chung, Kam Ping Peter
Khalil, Ahmed Moussa

Montesdeoca, Carlos Elias
Rubin, Barry

Trenkwalder, Andreas Erwin

MEng Herring, Ian Wallace

Patel, Dhiraj C

BSc Arndtke, James Stanton
Bertram, David Alexander
Bucholtz, William James
Chan, Wing Kit Victor
Cusack, Kevin Patrick
Dahouk, Mohammed Ahmed
Dimatita, Walter
Fong, James How
Glazer, Joseph

Graham, Ivine
Gwozd, William Peter
Hadyshevsky, Myron Joseph
Huston, Donald Fraser
Kenealey, Glen Brian
Kong, Stanley Chi-Keung
Labuhn, Ilse Amanda
Lam, Harry Yue Chung
Lau, Allan Chi Hung

Lee, Edmond Yam Hau
Luk, Samuel
MacArthur, Jack Allan
McDonald, Craig Warren
Meghani, Nazir Alibhai
Miners, Melvin Joseph
Mudge, David William
Ng, Tsan-Hang
Ormon, Karen Margaret

Ourfali, Mounir Ahmad
Proudfoot, William Alexander
Singh, Harkrishan
Six, Cameron Phillip
Tan, Raymond
Taylor, Raymond Mark
Ting, Frank Sin-Man
Werner, Thomas Arthur
Yu, Lawrence Lin-Leung

CIVIL ENGINEERING

PhD Aki, Fathy Abou Zekry Ahmed
Day, Robert Leonard

Elsawal, Abdel-Fattah Mohamed Y
Ewida, Ahmed Anwar El-Sayed

Khalil, Mahmoud Sobhy Ahmed
Khalil, Nagwa Abd El-Aziz E G

MSc Ameriy, Patricia

Bevington, Louise Marlene

Khalil, Mohamed Rashad A

Youssef, Hamdy Hassan

MEng Richardson, Hugh David

BSc Berry, John Douglas
Cameron, John Aloysius
Carson, Gerald Christopher
Chan, Alan Yuen-Sing
Chan, Chun-Hung Philip
Chan, Jimmy Ting-Yui
Chan, Kim Fong
Chan, Kit-Choy Kenneth
Che, Sai-Lam Eric
Cheng, Lai-Har Joyce
Choi, Kwan Chiu
Chow, Christopher Cheong
Choy, Man Yee Samuel
Dimanno, Valentino
Ferrer, Donald James

Foo, Charles Then-Boo
Grafton, Richard Jon
Grisak, Patrick Francis
Harms, Richard
Hildenbrandt, Ralph William
Ho, Li-Kwok Joseph
Jones, Terence David
Keung, Colin Pui-Yun
Kuyt, Avenil Margaret
Kwok, Eric Yu-Won
Kwong, Chung-Wai Alkin
Lai, Gilbert Lung-Kui
Lam, Chi Hung Arnold
Law, Ming-Kin
Lee, Cherk Pang

Lee, Frederick Shu-Shue
Lee, Nga-Chung Canton
Leung, Kit-Wing Henry
Lo, Yiu Cheung Peter
Lo, Kin-Kwan Isaac
Lo, Lai Yee Tonia
Loh, Lean Cheng
Luk, Kin-Cheong
Marsofsky, Václav
Myer, John William George
Neden, Gary Brian
Ng, Siu Kuen Simon
Plaskoski, Michael Edward
Rix, Douglas Walter
Siu, Neil Ping-Keung

Siu, Siu-Keung Kenny
Stepanek, Lidmila
Stewart, Brett David
Tam, Siu-Lun
Tse, Chi-Wai Henry
Wittstock, Edmond Peter
Wong, Eddy Yuman
Wong, Yuk Yee Allison
Yan, Michael Dick-Chung
Yeung, Sally Sai-Hee
Younger, Douglas Robert
Yuen, Hon-Yat Raymond

ELECTRICAL ENGINEERING

PhD Abou-El-El, Mohamed Shafik

Abouelwafa, Mahmoud Sami A H

Bengiamin, Nagy Nessim

MSc Divan, Deepakraj Malhar
Hriskevich, Brian Robert James

Krausas, Anydas
Lai, Richard Kwok-Keung

Lok, Yuen Kwan
Nath, Gautam

Sharaf, Tarek Ali Mohamed
Verghese, Sosamma

Dip Arnason, Dale Gordon

Farsi, Fereydoun

Hale, Alan Walter Griffith

To, Shun Wai Anthony

BSc Brown, Nicholas Arthur
Chan, Lai-Sang Stanley
Cheung, Paul Oi-Yai
Cheung, Sing-Sang Ringo
Dyck, Jack Peter
Forbrich, Hans Greg Paul
Goerzen, Lawrence David
Gonnason, William Roy
Ho, Chiu-Hin

Kam, Shun Hing Peter
Koltes, Rene Conrad
Kopjar, Anthony Cyril
Kopp, Norman William
Kosunen-Dodgson, Ellen Anita
Kowalewski, Gregory Joseph
Lau, William Yun-Hung
Lushington, Gary Robert
McIvor, James Robert

McNeil, Roderick John Kant
Mooney, Bradley Neil
Petersen, Gordon Howard
Purvis, James Duncan
Smerek, Patrick Lawrence
Tang, Siu Ming Eric
Thomas, Charles Ralph
Tong, Chung-Kwok
Tse, Kin Wing

van de Ligt, James
Wong, Po Wah Jan
Yee, Gabriel Wing-Ping
Yong, Yun-Hoi
Yu, Hailson Tze-Shan
Yuen, Donald

MECHANICAL ENGINEERING

| | | | | |
|------------|---|--|--|---|
| PhD | Botros, Kamel Kamel | Cronje, Johannes Stephanus | Khare, Jitendra Mai | Thawani, Prakash Tuljaram |
| MSc | Ibrahim, Gawdat Mohamed Saleh | Mohan, Krishneswami | Rehman, Asif Sheikh | |
| BSc | Agnew, Arthur Patrick
Biederstadt, Kar Christopher
Brager, Mark Victor
Bray, Robert Alan
Caple, Joanna Teresse
Chan, Alan Sze-Yuen
Cheng, Henricus Tai Kwong
Cheng, Ricky Kam Wah
Choi, Chun Fai Samuel
Chun, Shiu-K, Ambrose
Chung, Chi Kwong David
Chung, Paul Lik Sang
Connolly, David Wayne
Consul, Prayush Chandra
Elias, Richard Alan
Fan, Yuen-Chung
Freeman, Georgina Marie | Fung, Cheng-Man Phillip
Fung, Kin Chee
Fung, Pui-Lok
Fung, Tat Chung Thomas
Goodwin, Sean Wilson
Haigh, Robert Russell
Hemstock, Christopher Allan
Ho, Kar Kin-Chi
Hodgkinson, Peter Charles
Hui, Siu-Wing Harry
Ip, John Wang-Hong
Ko, Samuel Chee Sheng
Kohut, Douglas Ross
Lam, Hei Tung Ander
Lau, Wayne Kwok Chang
Laul, Stephen Wilson
Lee, Peter Koon Yau | Leung, Ewen Yui-Wang
Leung, Man-Sze Bendrick
Lim, Ronald
Luk, Andy Yu-Ho
Lung, Tin-Yick
MacLachlan, Allan Bruce
Mak, Anthony Keung
Mitchell, Wilma Elizabeth
Morin, David Emile
Mortimer, Donald Scott
Nabors, Charles Alison
Nardes, Robert Eligio
Ng, Siu-Wai Angus
Nicholl, Gordon Warren
Organ, Jan Carol
Pang, Wing-Cheung Vincent
Poon, Yiu Cheong | Scott, Jeffery Ear
Sidey, Peter
Sir, Tze-Leung
Slack, Maunce William
Smith, Stuart William
So, Siu Pong Peter
Szabo, Jason Les
Szeto, Edward Wai Mong
Tam, Siu-Lam
Thia, Toh Cheng
Thom, Robert Marlin
Tse, Douglas Fong Kwong
Weerahandi, Arivadasa
Wheatley, Duncan Noel
Wong, Kwai-Cheung William
Yu, Wai Keung |

1980

CHEMICAL ENGINEERING

| | | | | |
|-------------|--|---|---|---|
| PhD | Mehrotra, Anil Kumar | Vysniauskas, Anthony | | |
| MSc | Dwan, Mohammed Amin | Lee, Chang-Zen | Morris, Graeg Gibson | |
| MEng | Fontanilla, Jerry Pasco | Gray, Murray Ross | Wade, Roderick Paul | |
| BSc | Bauhuus, Barry John
Bell, William Gair
Brade, Douglas Richard
Chu, Siu Kam Bosco
Crowe, Malcolm Bruce
Dang, William
Foo, David Brian
Gobeille, Brian Frank
Graham, Mark Delmor | Hall, Kenneth Wayne
Hayden, Ernie Thomas
Huntrods, Richard Stanley
Jensen, Richard George
Joslin, Joel Kimball
Mah, John Wai
Manning, Terrence Richard
McCaughy, Judith Kathleen
McDonald, Barbara Louise Ellen | Nau, Josephine Sui Ying
Ng, Yuk-Man
Oberhofer, David Matthew
Picken, Sidney Douglas
Posehn, Douglas Brian
Reinson, Keith Allan
Saw, Dick
Slotboom, Sigward Geurt
Standing, Bruce Paul | Stewart, Craig Douglas
Stocker, Rudolf Konrad
Szabo, Attila Anthony
Thorssen, Donald Asher
Wong, Donald
Woo, Shun-Wai Joseph
Woods, Donald Wayne
Yeung, Wun-Bing Selina
Zibawi, Mohamad Ahmad |

CIVIL ENGINEERING

| | | | | |
|-------------|--|---|---|---|
| PhD | Barakat, Mohamed Aly Abdel-Salam | Elshatey, Osama Abdel-Bakki | | |
| MSc | Beddoes, Richard John
Dawson, David Thomas | Kumar, Vijaya
Lam, Joe Shing David | Maddock, William Patrick
Maes, Marc Altons | Nasim, Mushtaq Ahmad
van der Voet, Adrian Frank |
| MEng | Baragar, Harold Albert | Bower, Michael Richard | Szplett, David Bruce | |
| Dipl | Isaac, Roosevelt Adolph | | | |
| BSc | Argento, Tony
Bogart, Martin Leslie
Boorman, George William
Bowron, Douglas Joseph
Brander, Roy Robb
Chalecki, Christopher Zbigniew
Chan, Allan Sau Kit
Cho, Hui Cheung
Clark, Philip Joseph
Cruikshank, Ronald Keith
Cullen, David James
Elsaghi, Khaled Hussain
Fedirko, Wilmar Mitchell | Gee, Pinky Robert
Gou, Kok Hong
Jones, Darrell Craig
Kemp, Paul Geoffrey
Kernaghan, Kenneth Richard
Klym, Donald William
Koh, Seow Hong
Kraft, Harold
Lam, Chi Wing Eric
Lau, Si Io Alan
Leung, Kin-Yu Gregory
Leung, Tai Wuen Kenneth
Levere, Jeffrey Lawrence | Louis, Harry Chuk-Kwong
MacKinnon, Donald Hugh
McArdle, Khrys Robert Kahry
Ng, Siu Keung Jackson
Rakievich, John Alexander
Rudolf, Peter Paul
Russel, Paul Kerr
Ruus, Allan Michael
Schulze, Carl Hans
Seton, Laurence Hugh
Sit, Steve Chin Hung
Stradinger, Deborah Mae
Tong, Pui Kaung Sidney | Tsang, Kim-Fai Vivian
Tse, Kai Chung Stanley
Tse, Simon Po Lai
Tuttle, Hugh James
Virani, Akbarali Ali
Wloszyk, John Adrian
Wilkin, James Frederick
Wong, Allick Heng Him
Wong, Wayne Wai Leung
Yip, Cheung Chun
Yue, Pak-Lam
Yung, Ka-Po Peter
Ziegler, Gregory Wade |

ELECTRICAL ENGINEERING

| | | | |
|------------|--------------------------|----------------------------|-------------------------|
| PhD | Arunachalam, Vaidhyathan | Rao, Madanahalli Krishna N | Turner, Laurence Edmund |
| MSc | Chang, Jeh | | |

| | | | | |
|------------|---|---|--|---|
| BSc | Blackman, Julian Mark
Bliet, Robert Johannes
Candy, Michael Richard
Chui, Paul Wing-Sang
Clarke, David Joseph Paugh
Dallen, Wyllie John Richard
Dei, William York-Chew
Falkenstein, Michael Kenneth
Fung, Tony Kwok-Chung | Garrett, Peter Charles
Glanzer, John Harold
Groten, Harry James
Gunderson, Richard George
Henkel, Jay Louis
Hess, Shane Edmond
Hogg, Dennis Wayne
Hue, James
Jaques, David Edward | Ladick, John Nelson
Lee, James
Leseberg, Paul David Joseph
McKenzie, Marilyn Joan
McKibbin, James Kevin
Mills, Robert Mark Jardine
Neame, Roger Alan
Nelson, Kenneth Edmund
Noakes, James Alec | Peltrosky, David Paul
Podiluk, Michael Brent
Saar, Vera Alice
Shpak, Dale John
Stewart, Smith, Kenneth
Strecker, Timothy Car
Sun, Jim
Sung, Steve Din Ching
Yee, Ronald Ger |
|------------|---|---|--|---|

MECHANICAL ENGINEERING

| | | | | |
|-------------|---|--|---|---|
| PhD | Hanafi, Abdalla Sayed Ahmed | | | |
| MSc | Gupta, Padam Prakash | Ogundele, Gabriel Idowu | | |
| MEng | Khella, Alf | | | |
| Dip | Leung, Bendick Man-Sze | Yu, Wai Keung | | |
| BSc | Abday, David Michael
Ball, Keith William
Ballis, Christopher John
Bishop, Mark Dudley
Boghean, William Dale
Bosecker, Gregory Dieler
Brown, Daniel Curt
Brown, Scott Bruce
Chan, Dennis Chong-Tin
Comfort, Peter Robert
Dumont, DrArcy Lynn
Duncan, John Stuart
Elasz, Douglas Robert
Forbes, Gordon Richard
Garvin, Kenneth George
Grant, Robert Neal | Heslop, Kenneth Alan
Hogan, Steven Francis
Huitema, Andrew John
Kan, Chi Hung Raymond
Kopjar, Randall Martin
Kornfeld, Gordon Leonard
Kostluk, Les Wayne
Kryczka, Terrance Allan
Lam, Yau-Kai Matthew
LaPlace, Donald Charles
Leong, Kenny Fern
Lo, Roger Chi-Sing
Mak, Sammy Wing Cheung
Malyk, Michael Joseph
Mc Bride, Todd James
McCracken, Ronald Edward | McCuig, Robert Donald
McNichol, Douglas Oliver
Minhas, Manmohan Singh
Mok, Kin Chung Murray
Moreland, Brian Thomas
Nahas, Ibrahim
Pelzer, Douglas Andrew
Pow, Joks Elaine
Pow, Murray John
Purdy, Darrel Scott
Ruzicki, Gregory Leo
Scharrei, John Robert
Schramm, Ronald Casper
Smink, Willem Klaas
Spiering, Roland Maarten
Stobert, John Bray | Tam, Raymond Tat Wing
Taylor, David Cecil
Todd, Cameron Murray
Todd, David Blake
Tsun, Yeong Mao
Tsuen, Raymond Chun-Jack
Jinrau, Randy Markow
Vatsch, David Patrick
Wahl, Lee Art
Wong, John
Wong, Joseph Tak-Yan
Yanos, Ronald Thomas
Young, Simon Hon Wah
Yuen, Moses |

1981

CHEMICAL ENGINEERING

| | | | | |
|------------|---|---|---|--|
| PhD | Abou-Kassem, Jamal Hussein | Mehra, Rakesh Kumar | | |
| MSc | Chariker, Elkan Moses
Erian, Adel Naguib | Fong, David Kong-Sang
Ourfali, Mounir Ahmad | Sadiq, Farhan
Van Ham, Cornelius Jacobus M | |
| Dip | Chan, Frederick King-Wan | Krenz, Erhard | | |
| BSc | Adams, Kelly Lynn
Baillie, John Robert
Beatty, Wayne Edward
Becker, Kenneth Mark
Beckie, James Kenneth
Birkholz, Robert Karl Otto
Black, Kenil Douglas
Chornoboy, Rinda Karen
Christopher, Russell Glen
Cole, Douglas Harley
Corris, Debra Janine
Cummins, Andrew Gordon
Dau, Brian Harold
De Marco, Peter John
Edwards, Kelly Alan | Evans, Timothy Raphael
Freeman, Larry Wayne
Gair, Jeffrey Douglas
Geppert, ngnd Louise
Johnson, Barry Andrew
King, Alan Ross
Kondro, Gregory Michael
Kozioi, Helen Cathenna
Lancaster, Gregory William
Lawless, David Robert
Mac Donald, Donald John
Maffitt, David Walter
McCue, Arthur Allen
McKenzie, Warren Blain
McMullen, Arthur Lorain | Moe, Selma Marie
Monroe, David Charles
Mose, Frederick Leroy
Newman, John Robert
Nutakki, Ramagopal
Ovason, Robert James
Padamsey, Riaz Pyarali
Pike, Richard David Alan
Ragwan, Alkarim Abdulmalek
Rea, William Bruce
Renwick, Kathryn Leslee
Rutherford, Donna May
Salahub, Donna May
Schmidt, Glen Christian
Sheritt, Richard George | Sim, Douglas Wayne
Thomas, Forrest Brent
Thomson, Gregory Clark
Tier, Mary Patricia
Tinnmons, Robert Gary
Trieber, Mark Lewis
Virdi, Harjeet Singh
Ward, James Shawn
White, David Walter
Williams, Heather Gay
Wong, Fred Ping
Wong, Shanda Kuen
Wong, Terry Wayne
Yu, Chi-Sum Lawrence
Yung, Richard Sin Fung |

CIVIL ENGINEERING

| | | | | |
|-------------|---|---|--|--------------------------|
| MSc | El-Dagwy, Wael Mohamed
Ho, Herbert Hok-Bun | Janarthanan, Natarajan
Kellin, Kim Christopher | Krumins, Imants Voldemars
Lam, Hing-Keung William | Mitchell, Maurice Andrew |
| MEng | Issa, Ismail Mohammed | Truderung, Axel Udo Reiner | | |
| Dipl | Oliver, Henry George | | | |

BSc Aycock, Barbara Zan
Becker, Terry Woodrow
Buckle, John Eric
Cameron, Peter Keith
Carson, Clarke Emery
Cebula, Andrew John
Chen-See, Glen Edwin
Cheung, Chiu-Wing
Chow, Chi-Hung Albert
Cinkovic, Bozidar
Easton, Mark Anthony
Fung, Alwin Yee-Chi
Furnival, Bruce Alexander

Gough, Michael Brent
Heine, Richard Gordon
Hessels, Adrianus Johannes
Ho, Simon Yuk-Ching
Irvine, Robert Stuart
Jeffery, Barry Frederick Roy
Kung, Allen
Lam, Edward Wing Yu
Lam, Raymond Shui-Leung
Lee, Paul Chi Fung
Leong, Steven Jan
Li, Kar Ping Fai
Manty, John Charles Kenneth

McGinn, Sean Patrick
Modnyj, Jerry
Mutch, Kathryn Ellen
Nelson, Thomas Reed
Ng, Pang Chi
Nieuwenhuis, George Peter
O'Connor, Steve Thomas
Ohama, Walt Tona
Read, George Alfred
Saghafr, Abdolhossein
Salanski, Daryl Peter
Sandall, Peter Robert
Saunders, Robert Joseph

Scott, Charles Bruce
Sekella, Walter Peter
Springer, Arno Stephen
Suen, Andrew Mau Sing
Vahdani, Hassan
van Egmond, Trent John D
Wallace, Robert Gower
Yates, Anthony Barry
Yee, Thomas Chun Hong
Zeidakis, Janis Modris

ELECTRICAL ENGINEERING

PhD Bhagwan, Jai

Khan, Rafaat Husain

MSc Biagioni, Gary Samuel

Leparskas, Henry John Andrew

BSc Adamson, Richard Joseph
Boogaart, Marinus Machiel Lourens
Boury, Yousef Raja
Firth, Alan Edward
Gawdz, James Edward
Halbertsma, Johannes Gerlof
Ho, Albert
Iladis, Alexis

Klassen, Gerald Allan
Kowch, Eugene Russell Gordon
Le, Xuan Loc
Lee, Din-Kit Stephen
Lee, Thomas
Ma, Annissa Shue-Ying
Mah, Ronnie Wah
Martin, Robert Daniel

Mensik, Michael
Oberhammer, Wolfgang
Paschke, Dennis Dale
Sondergaard, Leonard Colin
Spink, Mark Alan
Spinner, Robert Eugar
Ten-Hove, Ronald Albert
Terrace, Donald Murray

Ung, Jack
Wong, John E
Wong, Sunny King Yau
Woodard, Robert William
Wu, Simon Saiman
Yeung, Paulina Sai-Fun
Zankl, Ernest Gary

MECHANICAL ENGINEERING

PhD Segev, Reuven

MSc Bayly, Donald Andrew

Lung, Tin-Yick

Pethrick, Wayne Daniel

Siu, Lung-Wai

BSc Amell, Donald Brent
Bachmann, Guido Christopher
Baird, Teresa Lynn
Biederstedt, Harold Edgar
Bonneville, Renaud Jules
Brown, Mark David
Bruins, Henry Charles
Burdylo, Ronald Steve
Candline, William McKee
Carr, Darcy Neil
Chow, Raymond Shui-Cheong
Chrusch, Larry Joseph
Chiu, Eric
Cornish, Ronald George
Cox, Robert John
Davis, Jeffrey Scott

Evens, John Robert
Filyk, Gordon Reed
Fischer, Richard Franz
Frederick, Carol Ann
Geddes, Stanley Gordon
Gressmann, Ronald Guenter
Grasdal, Warren Mark
Hannotte, Andre Joseph
Kaulback, Max Wilfred
Kelemen, Louis Julius
Kernlo, Kevin Allistair
Kolb, Hansjoerg
Lui, Joseph Kwok Hung
Lun, Roger Kwong-Kiu
Mallmes, Rodney Michael
Man-Son-Hing, Warren Evan

Matekoti, Jack Henry
May, Kevin Bruce
Mereau, Marc Laurent
Muir, Bradley Wilson
Naden, Richard Wayne
Nielsen, Eric George
Otynyk, Julia Anne
Pavakos, Paul
Pollitt, William Thomas
Rauch, Bruce Kenneth
Robertson, Robb Roy
Rosina, Robert William
Schmaltz, Richard Andrew
Schmidt, Brian Leslie
Schultz, Craig Donald
Seeger, Andrew Cary

Sondergaard, Murray Alan
Spice, Brent Norman
Sproule, Cathy Lynn
Stanley, Neil Alan
Tang Kong, Veethornia William
Trick, Mona Dawn
Tsang, David Hin Kai
Tychokis, Timothy Robert
Unruh, Ernest Henry
Uptigrove, Stanley Ormond
Vittachi, Amal Ronaka
Wong, Keith Malcolm
Woo, Martin Fong Kin
Yakimishyn, Kenneth Michael
Yanchula, Robert James
Zboya, Timothy Mark

SURVEYING ENGINEERING

BSc Boyd, Peter Gordon
East, Warren Craig
Fenton, Patrick Charles

Gowing, Barry Duane
Johnston, Gordon William
Larsen, Kenneth Michael

Schleppe, John Brian
Tarle, Terrance Lee
VandenBrink, Dirk Henry

1982

CHEMICAL ENGINEERING

PhD Adegbesan, Kehinde Olutunmbi

MSc Diaz, Noe Damian

Khan, Mohammed Ali Baboo

Sudarsan, Gopalaswamy

Yuan, Bevan Bun Wo

BSc Armstrong, Ronald Leslie
Campbell, Jeffrey Glen
Chhina, Harbir Singh
Crawford, Douglas John
Dilger, Christoph Walter
Frederick, Lawrence Joseph
Gordon, Karen Margaret
Gretener, Nicholas Martin
Heinen, Wayne Bradley
Hilton, Charles Ernest
Howell, Stephen Leslie
Hugo, Allan James

Hugo, Wayne Francis
Ince, David Brian
Ingles, Catherine Anne
Kamel, Mohamed Bassam
Kantan, Roy Ward Michael
Kelly, Brian James
Kloepfer, Clarence Bruce
Kwan, Larry Lou
Lakhani, Amin Mohamed
Leibert, Roderick Joseph
Lo, Yim-Choi
Mawdsley, Karen Elizabeth

McDougall, David Wayne
McLeod, Lyle Theodore
Melon, Joseph
Ness, Brian Joseph
Newman, Margaret Yvonne
O'Connor, Stuart Graham
Okuefuna, Anthony Uzodima
Ontko, Bruce Alexander
Peltzner, Elana Alexandra
Pyo, Kar Keel-Woong
Remtulla, Fandi Fatehali
Ross, Mark Robert

Saeger, Roland Bernard
Schneider, Cameron Eugene
Shellan, Michael Hugh Francis
Trumble, Kenneth Edward Joseph
Varga, Emery Peter Joseph
Vore, Nelson Christian
Waidbauer, Patricia Ann
Wallace, Jacqueline Ann
Wong, Glenn Douglas
Yee, Paul Wing Foo
Yip, Sam Shee

CIVIL ENGINEERING

| | | | | |
|-------------|---|--|--|---|
| PhD | Ameny, Patrice
Ghoneim, Nadia Sobhi A-N M | Gray, Robert John
Jokkanen, Matti Juhani | vebo, Ake Lennart | |
| MSc | E-Badry, Mamdouh Mohamed A H | Gugenhan, Hannes Gustav | Mahmoud, Hefny Mohamed H | Padmanabhan, Balakrishnan |
| MEng | Tandon, Suninder Kumar | | | |
| Dip | Lee, Hon-Cheung | Simbeya, Kazombwa Wycliff | | |
| BSc | Adams, Robert Michael
Borowski, Andrew Janusz
Bunning, Douglas Francis
Buck, John Canning
Buckley, Michael John
Burke, Lyle Howard
Champlin, Crispin Hisopri
Chan, Wing Kai Moseman
Chow, Dewayne Wing Foon
Chow, Wallace Donald
Crotph, Christopher Michael
Cummings, Alexander Gerald
Dalton, John Edward | Dearstyne, Loraine Margaret
Flag, Myles Howard
Fulowski, David Edward
Gillett, Roger Bruce
Goldade, Jennifer Ellen
Grondin, Kevin Charles
Gunst, Alan
Harris, George Arthur
Hinger, Reynold Victor
Hui, Siu-Kwong Andrew
Hundell, Lillian
Hust, Ronald Wayne
Jans, Reginald Dwayne | Kuharchuk, Terrence Neil
Le, Hoa Thai
Lee, Arthur Wayne
Lee, Henry Shu-Hei
Li, Edmund Chi-Ming
Lowther, Ronald Coleman
Mangat, Jagarwan Singh
McGinn, Paul Michael
Moeti, Thabo Tshololelo Thando
Mthemba, Andrew Fana B
O'Hara, Michael Brian
Ong, Tee Sing
Rooop, Ateesh Chandra | Shaw, Lance Michael
Smith, Stephen James
Stanton, Robert David
Tang, Kong, Robert
Thomas, Paul John
Troskot, Dusko
Watson, Dale Calvin
Wright, Stephen Sherman Lee
Wunsch, Dirk Ulrich
Zielke, Walter Albert |

ELECTRICAL ENGINEERING

| | | | | |
|-------------|--|--|---|---|
| PhD | Kanniah, Jagannathan | Sharaf, Tarek Ali Mohamed | | |
| MSc | Seneviratne, Lahiru Mohan | | | |
| MEng | Shpak, Dale John | | | |
| BSc | Aldridge, Darren Todd
Arnall, William George
Bannmann, Nikolaus George
Beatty, Ross Lloyd
Bertrand, Daniel
Boeltcher, Andrew James
Campbell, Kevin John Maclean
Chebib, Elie Toufic
Chrusch, Catherine Mary Ellen
Cooper, David William
Dang, Norman Chung Men
Day, Leslie Allan
Dean, William Peter | Fitzpatrick, Gary Frederick
Freed, Ronald Edward
Fryk, Brian Leo
Geddes, Matthew John
Greve, William Lawrence
Gulstene, Kevin Mark
Hall, Michael Mackenzie
Hardy, Gordon Roy
Hewitt, Lawrence Bruce
Hodgson, Lauren Clark
Howell, Gordon Alexander
Juras, James Robert
Koskovich, Gregory Nicholas | Leckie, Brian MacGregor
Lindland, John Gerard
Marecek, David Paul
McLeod, Robert Douglas
Miskath, Kristina Suzanne
Nelson, Sharon Anne
Procter, Michael Andrew
Purtill, Patrick Joseph
Rindt, Dean Ernest
Ritland, Gary Lewis
Staples, Howard Keith
Stichbury, Robert Grant
Stichling, Wolfgang Joachim | Swain, Alan Lawrence
Tanner, Bruce Lee
Tay, Cheng Guan
Tremblay, Guy Elzeai
Truong, Henry Dat Quang
van Der Meulen, Ronald Frank
Walker, David Jonathon
Wallace, Richard Andrew
Wanglee, Charmanee Ling
White, Dean Cameron
Wong, Kin Chi |

MECHANICAL ENGINEERING

| | | | | |
|------------|---|---|---|---|
| MSc | Amoozegar, Nezameddin Fasaie
Boon, Soon Luke | Gozde, Sedat
Kibria, Mohammed Golam | Panilio, Juan vladimir P H d P
Sonano, Benjamin Pardo | Tam, Edwin Sui Lam |
| Dip | Ibrahim, Samy Riad | Maikhaill, Safwat Habib | | |
| BSc | Blemans, Roger John
Bilozii, Mark Alexander
Brown, Walter Kelly
Chow, Chiu Chun
Clarke, Barry Dean
Crawley, William Denis
Donnachie, Patrick Joseph
Dredger, Dirk James
Druhall, John Lawrence Blaine
Elsaghir, Adnan Hussein
Evans, Thomas Edward
Fehr, David Daniel
Finnestad, Dean Jeffery | Flegat, Michael James
Forrest, John Allan
Frank, Morley Shay
Hay, Joanne Laura
Hazelton, Douglas John
Iannaltona, Gerardo
Jensen, Lawrence George
Jonk, Eric Frederick
Kenelick, Ross Wayne
Kroshus, John Bryerton
Labrecque, Barry Lee
Leung, Donald David
Lutz, Ronald Edmund | MacDonald, Christopher Robert
Maekelburger, Harry Gunther
Mah, John Wai
Mang, Silas
Mawdsley, Donald Mark
McGinn, James William
McGowan, Lynn Carita
McGregor, Brian Evan
Mikiei, Tadeusz John
Mikkelsen, Ronnie
Miller, Melvin Louis
Moore, Gregory Wayne
Paul, Hendrik Willem | Perry, Donald Arthur
Rath, Paul Jacob
Rohling, Gerald Francis
Schmelz, Eric Gabriel
Siebold, Quentin Ralph
Silbernagel, Wayne Stanley
Stephen, Douglas James
Stephens, Bradley Wade
Stephenson, Sam
Swystun, Roy Leonard
Tompkins, Mark Douglas
vanderpuiten, Tanya Maureen
virtue, Jephson Charles |

SURVEYING ENGINEERING

| | | | | |
|------------|---|--|---|--------------------------|
| MSc | Wong, Richard Yoon Choong | | | |
| BSc | Arden, Dale Arthur George
Ballis, Brian Alexander
Fee, John Jeffrey | Green, Stephen Campbell
Mackenzie, Andrew Philip
Martin, Allan Frederick | O'Neil, Shendan Anne
Riz, Kenneth Daniel
Santorelli, Nicola | Schmidt, Michael William |

1983

CHEMICAL ENGINEERING

| | | | |
|-------------|---|--|--|
| PhD | Rao, Dandina Nagaraja | | |
| MSc | Dalhous, Mohammed Ahmed
Hanumanth, Gurumkonda S | Kulkarni, Tammaji Govindrao
Nutsikk, Ramagopal | Sarkar, Shankar
Singh, Balbir |
| MEng | Horner, William Norval | Huang, Kuo-Lon | |
| Dipl | Ibrahim, Saad Riad | Quillian, Ronald Gene | |
| BSc | Baizun, Graham Charles
Bilozzi, Diane Ethel
Boole, Kirk Sidney
Bradley, Steven Edward
Buchan, Walter Ewing
Burge, Robert Kendall
Butala, John Leslie Daniel
Creed, Beth Lorraine
Dhakwal, Gurminder Singh
Elchuk, Bonnie Joan
Gilmore, Robert John
Gwozd, Philip Thomas
Hardock, Patrick John
Harrison, Douglas Mark
Henzlmeier, Dennis Michael | Henley, Robert Dean
Hladyshevsky, Mark John
Hnatjuk, Bryan Mark
Jamal, Alnoor Hassanali
James, Neil Edward
Johnson, Susan Elizabeth
Jones, Michael Stuart
Khounieh, Antoine Atallah
Krieborn, Yosi
Kukowicz, Cyril Joseph
Latebyre, Louis-Charles
Leung, Raymond
Liew, Victoria Shien Fern
Long, Daniel Ward
Manoram, Kevin Joseph | McNeill, Rob Ward
Mitchell, David John
Montemurro, Mark Anthony
Murji, Aty Gulamali
Negenman, Tom Joseph
Nevison, Grant Walter
O'Dell, Brent David
Patence, Gregory Scott
Petropoulos, Larry van
Salahub, David William
Saundh, Gurcharan Singh
Scarpino, Luciano
Scott, David Donald
Shariff, Riyaz
Siqueira, Royden Julian |
| | | | Smith, Garry Allan
Spahl, Martin Conrad
Stanstreet, Mark Courtney
Tod, David Brian
Topolinsky, Kenneth Michael
Wee, William
Weiss, Doris Karen
Weiss, Michael Armand
Wichart, Robert Edward
Wobma, Paul Cornelius
Wojuola, Tunde Abiodun
Woo, Gary
Wright, Douglas McRae
Yee, Chi-Tak |

CIVIL ENGINEERING

| | | | | |
|-------------|--|---|---|---|
| PhD | Khalil, Mohamed Rashad Ahmed | Nessim, Maher Aziz | Razaqpur, Abdul Ghani | Sivakumaran, K Swayenasundaram |
| MSc | Mokhtar, Abdelsalam Ahmed
Nait, Gunendar Singh | Tam, Sui Jun Timmy
Tiong, Khin Soon | Wong, Alison Yuk-Yee | |
| MEng | Chakravarthy, Arun Kumar
Dozza, Peter Severino
Field, Thomas | Ircher, Kurt Karl Josef
Lamb, Garry Alexander
Lau, Raymond Jit-Yu | Prasad, Brahm Deo
Tse, Chi-Wai Henry | |
| Dip | Chow, Brian Wayne | | | |
| BSc | Abrahamson, Garman Wayne
Attenmueller, Walter Rolf
Barry, Michael Moorson
Becker, Stuart Donald
Blekhman, Roman
Blum, Michael Gerhard
Bray, Calvin Douglas
Dale, Scott William
David, Vincent Joseph
Dustan, Neil George
Evans, Donald Kenneth
Grandan, James Allen | Haigh, Richard Arthur
Hartz, Kevin Michael
Hoath, Richard Gordon
Horne, William Thomas
Horsfield, David Wayne
Johnstone, Stephen
Joyce, Peter Garry
Kau, Benedict Chi-Man
Kattapuram, Mathew Shahjan
Kollas, Sam Sotinos
Kostashuk, Michael George
Kripan, Ronald Nick | Jay, Joel Alan Marc
Ludtke, Gordon Julius
McPeak, Theodore Doyle
Molots, Tsholofelo
Miraz, Peter Anthony
Ngwenya, Isaac Mphikelele Veni
Nyirongo, Paul Wil
Pasteris, Marco
Potter, Allan John
Rath, Gary Michael
Saunders, Kerry Patrick
Tam, Joseph Then Yuen | Tidball, Bruce Edward
Tsoi, Helena Miu-Kwan
Turner, William Michael
Vaspa, Thomas
Weeres, Gregory Blair
Wenzel, Alexander Werner
Wong, Kwok Keung
Wright, Wesley Hugh
Yip, Kenneth Han
Yogasundaram, Somasundaram
Zwane, Siza Mzwandile |

ELECTRICAL ENGINEERING

| | | | | |
|-------------|---|---|---|--|
| PhD | Aggarwal, Sushil Kumar | Divan, Deepakraj Malhar | Modi, Asghar bn | |
| MSc | Angus, Allen Douglas
Le, Xuan Loc | Liu, Erwin Sak Ki
Mahana, Prem Nath | Ng, Mark
Shaw, Gregory Ridley | Strecker, Timothy Car |
| MEng | Grant, Trevor Linden | | | |
| BSc | Altum, Troy Christopher
Bakker, Peter Darren
Bishun, Mata Persaud
Bonang, Darcy Alexander
Boyd, Jeffrey Edwin
Brown, Patrick Martin
Charko, Rod Eugene
Chow, David George
Colpitts, Donald James
Cornish, Darryl John
Costigan, Patrick Ryan
Danielewski, Olgierd Tomasz
Diocee, Sawant Singh
Doubler, Philip John | Eng, Isaac Igy
Griffith, James Stephen
Guest, Bruce Bissett
Harding, Walter Jess
Hebert, John William
Hegberg, Larry John
Hiller, Ronald George
Hung, Paul Kong-Yee
Jorgensen, Kenneth
Keashly, Dusty
Keet, Robert Henry
King, Daniel Arthur
Kinsella, Dale Ross
Kwan, Henry Siu Lan | Lambert, Venita Anne
Lanos, Edwin Mark Gerard
MacDonald, John Michael
McDonald, Daniel Michael
McLennahan, Mark Reginald
Meier, Douglas Ronald
Morganson, Sharon Dorothy
Murdock, Daijeet Singh
Neufeld, Leona Arlene
Noble, Craig Ronald
Oxtoby, David Michael
Penny, Keith Arthur
Pon, Ken Sang Kan Sheng
Pruden, Gordon Lange | Ruff, Darcy Elmer
Scott, Kenneth Edward
Shamman, Glenn David
Staples, Gary Roy
Turenne, Raymond Joseph
Williams, James Ralph
Withey, Daniel James
Wong, Harry
Wong, Alex Sau-Shing
Wong, Victor
Wood, David Allen
Yee, Jim Yung Wang
Young, Cameron Stirling |

MECHANICAL ENGINEERING

| | | | | |
|-------------|---|---|--|---|
| PhD | Al-Ajousi, Yaruib Hamdi King, Rodney John | Abdiabboh, Mohamad Abdelmonem A Hanna, Magdi Awad | Hessami, Mir Akbar | |
| MSc | Sran, Baldev Singh | Srinivasan, Visvanathan | Tas, Ibrahim | Vardi, Ilan |
| Dipl | Gray, Robert Ernest | Wei, Pei Tje Peter | | |
| BSc | Anderson, Keith Brian
Anderson, Neil Robert
Antonaccio, Flora
Beatson, Geoffrey William
Brown, Allan Peter
Cameron, Ian James
Carber, Glenn William
Checknita, Douglas Walter
Chilton, James Douglas
Choi, Joseph Yin-Wah
Cole, Gerald Kenneth
Demuth, Michael Norman
Deyar, Michael Ralph
Frederick, Hudson Gerald
Fydtell, Harry Robert
Gell, Steven Robert
Gleason, Cecil Thomas
Gow, Lisa Ann
Grant, Anna Lynn
Hale, David James | Halim, Wawan
Hansen, Lorraine Margaret
Hillje, Walter Eilert
Hindemith, Markus
Ho, Steven Tan
Holden, Gary Robert
Hornett, James Philip
Ironsides, Trevor John
Jorgensen, Jack
Kennett, Andrew John
Ker, Ee Lian
Kostiuk, Larry William
Kula Jr, Leonard Waller
Laureshen, Catherine Jean
Lazic, Pavle
Le, Xuan Phong
Lee, John Shu Wah
Leong, Henry Man Fai
Leurer, Randai Jay
Link, Lindsay Robert | Lo, Kin Keung Matthew
Loucks, David Arley
Lubey, Peter Albert
Ma, Victor Tai Tsun
MacDonald, Dan Matthew
MacFarlane, James Walter
Mar Tawsh, Bruce Edward
Martin, David Gordon
Mattinson, William David
McInnis, Cameron Douglas
McMahon, James Keith
Morrison, David Scott
Oszust, Donald Michael
Parr, Samuel John
Peters, Bruce Alfred
Pustanyk, Randai Harold
Rabusic, Frank George
Renborg, Bengt Anders
Robertson, Ross Gordon
Rodgers, John Arthur Whitney | Rossiter, Paul Gerard
Ruzicki, Douglas
Scott, Shelley Ann
Skretka, Randy Philip
Stewart, Gary Kenneth
Storey, Paul McKinnon
Strom, Vernon Lindsay
van Tetering, Donald James
van Wieren, James Arnold
Vermeulen, Stephen Owen
Volk, Glen Andrew
Vrielink, Hank John
Wakefield, Ronald Derek C
Williams, David Ross
Woo, Charles
Wright, Monte Neil
Zahary, John Empey |

SURVEYING ENGINEERING

| | | | | |
|------------|--|---|---|--|
| MSc | Mephart, Michael Patrick Arthur | Paine, Steven Hugh | Stoliker, Paul Craig | |
| BSc | Barnard, Warren Emerson
Bursa, Miroslav
Campbell, James Stephen
Crydenman, Christopher Shawn
Curne, David Hunter | Cutting, Brian Percy
Eddy, Patrick Ralph
English, John Joseph Harold
Fraser, Brent William
Godard, John Charles | Katsurs, Dimitra
Lethaby, John Jeffrey
Lyall, Robert Gordon
McDonald, David Hugh
Pileci, Joseph | Ponce, Ricardo Nicolas
Porter, Todd Russell
Ross, Brian Derek
Jindenwood, Bruce Donald
Wanless, Brent Alan |

1984

CHEMICAL ENGINEERING

| | | | | |
|-------------|--|--|---|---|
| PhD | Berk, Dimitrios | Nzekwu, Ben Ifeanyi | | |
| MSc | Banerjee, Abhijit
Jaffer, Taslim Mohammedali R | Parsons, Robert Vaughan
Sarker, Mallika | Sarma, Hemanta Kumar | |
| MEng | Dilay, Gary William | Stewart, Bruce Robert | Thomas, Forest Brent | |
| Dipl | Carmelotes, Ir Jose Jocson | Ralke, Gerald Alvin | Tsuen, Raymond Chun-Jack | |
| BSc | Baker, Thomas Joseph
Banks, Charles Thomas
Bennion, Douglas Brent
Berg, David Allen
Bowers, Maura Jennifer
Charlton, Henry Elbert
Chung, Yin Fong Kim Chung
Coates, Grant William
Cooper, Michael Glenn
Cummings, Stephen Charles
Davies, Jacqueline Ann
Demchuk, Mark Paul
Dunnell, Mary Kathleen
Dusterhoff, Dale Merin
Eddy, Derry Burton | Fisher, James William Boyce
Fitkin, Gordon Ross
Fitzhenry, Lynn Christine
Fryk, Robert Brent
Guilherme, Carlos Jose
Hanson, Kevin Robert
Hustad, Christopher Michael
Jos, Brian Michael
Kappelhoff, Ralph Ludwig
Koon, Darren Wai Hong
Lai, Cassandra Ka-Wah
Lee, Christina Wai-Ming
Low, Granger James
Ma, Daniel Kam-Chi
Maddocks, James Richard | Mah, Sam
Mallabone, Catherine Laurie
McCue, Kenneth Dale
McIntosh, Andrew Ryan
McKinnon, Stephen David
Milne, Bruce James
Moriyama, Robert Todd
Mottus, Kenneth Carl
Murji, Anar Yusuf
Oberhofer, Mary Jane Catherine
Power, Michele Karen
Price, John Scott Ward
Robertson, Dean William
Scarth, Brian Raymond
Schlenker, Ronald Car | Shannon, Ronald Hamish
Sherwood, Leonard Irwin
Slagg, Terrence Albert
Tsui, Raymond Yun Shek
Jrsenbach, Matthew Gerald
Van Engelen, Ralph Jozel
Varga, Monica Elizabeth Rose
Vaughan, Darcy Sheldon
Virginillo, Bradley Kay
Virginillo, Cindy Lou
Walz, Wanda Mary
Webster, Craig Donald
Woo, Roy
Zelinski, Robert David |

CIVIL ENGINEERING

| | | | | |
|-------------|---|---|-------------------------------|-----------------------|
| PhD | Babalola, Abayomi | Seneviratne, Pranka Nalin | | |
| MSc | Beersing, Anil Kumar
Divakar, Mysore Purushotham | El Rahman, Manal Mahmoud Abd
Oswell, James Michael | Shehata, Martina
Sise, Ali | Yogendran, Velupillai |
| MEng | Pedwell, Keith Gordon | Wilke, Paul Walter | | |
| Dip | Guinguis, Said Naguib Miled | Pearson, Winsley Richard | | |

| | | | | |
|------------|---|---|--|---|
| BSc | Atwood, Denis Larry
Blackmore, Mark Andrew
Boulton, Jane-Louise
Chiacchia, Marcello
Chiste, Carol Kim
Choles, James Edward Stanley
Choy, Hok Sum
Chui, Danny Che-Wing
Dagnault, Brent James
Date, Brent Anthony
Day, Kevin Clifford
Denhoff, Dale
Dudzinski, Paul Justin
Dunnwood, Walter John
Genereux, Grant Jerome | Gerlitz, Ronald Albert
Guy, Gerald Frederick
Harker, Vincent Grant
Hartford, Randall Wayne
Irvine, Grant Morris
Johnston, Robert James
Jonasson, Donald Andrew
Kabbani, Hicham
Kap, Edward Tsu-Teh
Kyle, James Ralph
Lalani, Nazim Sultan Hajeer
Lau, Wai Hung
Lee, Raymond Wing-Geet
Leong, Donald
Lowe, James Michael | Mah, Raymond
Manning, William Neil
McGillivray, Grant Thomas
Meek, Terence Stanley
Mietz, Sebastien Benala
Naus, Jaroslav
Oberholzer, Elizabeth Ann
Oshust, Brian James
Pertridge, William Maurice
Paul, Alan Ewalt
Penner, Vernon Henry
Pope, Thomas Bradley
Reinholz, Bradley Bruce
Renwick, Rodger James
Roberts, Kenneth Allan | Schurling, Adrian William
Smith, Randal Bauer
Smith, Terry Richard
Spurgeon, Mark Ernest
Stelm, James Richard
Szoke, Nicholas Tibor Joseph
Tomecek, Brian Austin
W, Ernest Juk-Chai
Vavsblat, Mark Alexander
Volcko, John Brent
Wall, James Stephen
Wearmouth, Jeffrey Mark
Whitney, Barbara Joanne
Wong, Calvin
Yeung, Winnie Sai-King |
|------------|---|---|--|---|

ELECTRICAL ENGINEERING

| | | | | |
|--------------|---|--|--|---|
| PhD | Dasgupta, Kumar Shankar | Ghosh, Anindam | Hriskevich, Robert Brian James | Nambun, Nageswara Rao |
| MSc | Iladis, Alexis
Klassen, Gerald Allan | Patel, Sunil
Truong, Henry Dai Quang | Yan, Wai Hung | |
| ME ng | Rindl, Dean Ernest | | | |
| BSc | Ali, Isaf
Amery, Sulman Khaled
Bodell, Kent Graham
Bons, Edward George
Buhler, John Martin
Bullen, Derek Shaun
Campbell, Colin Mason
Chan, Chuen-Yin Jonathan
Chmilar, David Walter
Damji, Ali-Kanna Amirali Kassam
Davidson, Bruce Richard
Davidson, Gordon Wayne
Davies, Whitney
Elms, Gregory Arthur
Emard, Timothy Edmond Peter | Engman, James Spencer
Enckson, James Francis
Forbrich, Alfred Emil
Ghitter, Monty Elliott
Gwens, Keith Wayne
Graham, Douglas Alan
Hadri, Lindawati
Hagerman, Darcy Darrell
James, Ian Edward
Jameson, Dale Scott
Jansen, Craig Arnold
Jorgenson, Mark Brady
Josephs, Ronald Theodore
Khan, Najir Ally
Klassen, Rodney Hugh | Krentz, Herman Bruno
Krochenski, Stephen John
Kupidy, Ronald Andrew
Lejeune, Randall Wade
Long, John Robert
Mah, George
Marble, Robert Duncan
Marrett, Avalon Patrice
McEwen, Andrew Edward
McLurg, Craig James
Meizer, Manfred George
Meredith, Geoffrey Owen
Mori, Ernest
Ng, Alexander Kwok-Kuen
Nichols, Stacy William | Paslowski, Daniel John
Pluemeck, George Gerhard
Pon, Nancy Jean
Shi, Edward Hing-Luen
Tan, Wee Tiong Danny
Terrill, James Christopher
Tran, Trung Cong
Tsohng, John Edward
Wadron, Brian Ronald
Walters, Jeffrey Lorne
Watlam, Michael Anthony
Wong, Raymond
Yavis, Patrick James
Yuen, Douglas Tak-Ming |

MECHANICAL ENGINEERING

| | | | | |
|-------------|--|---|--|---|
| PhD | Ogundele, Gabriel Idowu | | | |
| MSc | Akalekin, Ifeoluwa Sam
Fan, Yuen-Chung | Gill, Kashmir Singh
Kaladi, Vasudevan Mundakizhi | Porter, Samuel
Roy, Gregory Andrew | Sharif, Md Ali Rob
Vaidyanathan, Janakraman |
| Dipl | Aligzakis, Aris | | | |
| BSc | Ang, Elm Oy
Banman, Ronald Mark
Bergens, Helga
Berti, John Paul
Blanc, Christopher John
Bowden, Barry Keith
Brennan, Robert William
Buttenworth, Ian Douglas
Callander, Gary Russell
Chia, David
Chow, Andrew Pok-Hung
Chow, Robert Shi-Ling
Clausner, Ralph Michael
Cornfield, Robert Kenneth
Cowitz, Brent Lewis
Currie, Janet Anne
Dokter, Ralph Anthony
Forsyth, Dwynni David | Fountain, Alan Maurice
Geppert, Norman Sigvald
Harvey, Paul
Herriman, Gordon Lawrence
Hess, Emil
Holmstrom, Todd Marvin
Homer, Brian John
Humeniuk, Wade Joseph
Jacques, Gerard Edward
Junge, Michelle Clara
Kirkwood, Michael Bernard
Kostashuk, John James
Klzyk, Thor
Linscher, Daniel Joseph
Lisowski, Derek Lee
Lupton, Stephan Ernest
Ma, Tony Yu-Hung
Mark, Rann Albert | McGinn, Frederick Martin
Murakami, Craig Kenji
Murray, Cameron Allen
Nagy, Emil Joseph
Neave, Paul Davis
Neville, William James
Nguyen, Co Duy
Nijjar, Tarsem Singh
Oibrelter, Richard Peter
Orr, Andrew Carlyle
Poole, Donald Jay
Pyo, Sam Sung-Woong
Rambaransingh, Hardwick Francis
Robinson, Michael Frederick James
Schaffland, Roger Mitchell
Shopperly, Christopher Kenneth
Simington, Ron Gordon
Sims, Derek Mervin | Siska, Matej
Sklenka, Stefan
Stoof, Brian Mark
Solinger, Richard Frank
Spencer, Grant Douglas
Staniland, John Edward
Steghaus, Anne Kathrine
Strange, James Barry
Tshelus, Gabotshwarege
Uptgrove, James Richard
Wallace, John Mark
Wierzb, Pawel
Wilcox, James Ronald
Wong, Tammy
Young, Cameron Gregg |

SURVEYING ENGINEERING

| | | | | |
|------------|--|--|---|---|
| MSc | Ferland, Remi
Gonthier, Michel | Sideris, Michael George
Teskey, Theano Nodarakis | Vassiliou, Anthony Andrew | |
| BSc | Bates, Philip Thomas
Cannon, Margaret Elizabeth
Cloake, Douglas Allan
Laplante, Lance Charles | Lera, Carlos Joseph
MacKenzie, James Ramsay
McLardy, Dougald
Neufeldt, David Wesley | Sanden, Douglas Clair
Scheer, Laurie Wayne
Watkins, Shelly Jean
Wong, Kin Chai | Wong, William Paul
Woods, Michael Vaux |

1985

CHEMICAL ENGINEERING

| | | | | |
|-------------|---|--|---|--|
| PhD | Kim, Hyo Chee | Rizvi, Syed Saquaiat Haider | | |
| MSc | Ghosh, Tushar Kant
Henley, Robert Dean
Johnson, Susan Elizabeth | Nayar, Arun Kumar
Rijkers, Marinus Petrus Wilhelmus
Saeger, Roland Bernard | Siqueira, Royden Julian
Wozniak, Wladyslaw
Yee, Chi-Tak | Yu, Chi-Sum Lawrence
Zibdawi, Mohamad Ahmad |
| MEng | Cheung, Vincent Wing-Chuan | Picard, David James | Spoldi, Sergio | |
| DipI | Chang, Ricky Kam Wah | | | |
| BSc | Balachandran, Murali
Bandeli, Jalia
Bergner, Heather Leah
Bosch, Darryl John
Campbell, Barry Clarke
Chan, Alexander Daniel
Chong, Richard Fook Sing
Chow, Yuen Yu
Clippie, Cindy Lou Wolfe
Collins, Michael Laurence
Fachini, Thomas James
Fairburn, Judy Ann
Foster, Gary Alan
Furlan, John Michael
Garrison, James Edward
Goebel, Todd Kenneth | Habtom, Stefanos
Halton, Esther Jean
Hampson, Gregory John
Hancock, Susan Karen
Hassam, Mohamed Shamsudhin
Hollis, Edward Douglas
Hugo, Linda Verona
Jivani, Zahir
Kabatek, Peter
Kassam, Alnashu
Kehoe, Tim Joseph
Keith, John Edward
Kelly, Colleen Diane
Kim, Irene Insun
Kohse, Bruce Frederick
Kopeck, Josef Jan | Leung, Karen Kuen-Kuen
Matthews, Paul William
Miller, Roderick Gerald
Miner, Paul Stefan
Mukherjee, Anil
Opheim, Mark Lee
Parkington, Jordy Cecil
Pater, Neha
Peake, Heather
Pickett, Russel Ward
Prani, Alamin Badrudin
Quon, Gene Wallace
Ritzen, Jeffrey Allan
Ronaghan, Kenneth Sparky
Sawatzky, Kent Lambert
Schulz, Marcus William | Serhan, Kamal Elias
Skelton, David
Sloof, Christopher John
Somerville, Michael Thomas
Spark, Wade John
Sugianto, Setiawardjono
Switasa, Kenneth
Taylor, Mark Douglas
Yink, Andrew Alexander
Waite, Lawrence Arthur
Webster, Dean Alan
Westby, Steven Vincent
Wick, Gregory Wayne
Wise, Richard Morgan
Wu, Edmond Yee Mean
Young, Leslie Ruth Bryant |

CIVIL ENGINEERING

| | | | | |
|-------------|--|---|--|---|
| MSc | Ghosh, Asok Kumar
Griffiths, Frederick John | Lam, Edward Wing Yu
Mahmoud, Suaded Shaki | Simbeya, Kazombwa Wycliff
Wijeweera, Harsha | |
| MEng | El-Degwy, Maha Hussein Abdou Ali
Kurby, Joseph Alan | Lancione, Antonio
Leung, Pak-Keung | Pierre-Belgrave, Theda Elaura
Traynor, Brian Gerard | Yuen, Raymond Hon-Yat |
| Dip | Varshney, Navin Kumar | | | |
| BSc | Abemethy, Ronald Wayne
Bou, Shao-Ho William
Bredero, Maarten Douwe
Brocklebank, Kathryn Lee
Brown, Kevin Edward
Buck, Stephen George
Chai, Michael Ping
Chikmoroff, Michael Ken Brian
Dera, David Duane
Eberhardt, Steven
Fitch, Murray Alan | Foo, Patricia Mar
Gerlach, Eric Norman
Gill, Manjinder Singh
Hampden, Cornwell Mokola
Henderson, William Vincent
Keys, Robert Avar
Kua, Jark Loi
Kuyt, William Adam
Loft, Matthew Finch Kitchener
Marks, Gregory Augustine
Massoud, Charbel | McNris, Duncan Arthur
Miller, Duncan Stuart
Morrow, Kirby Brant
Murrell, Robert John
Mushins, Michael William
Othof, Margarita Irene
Pelkey, Robert Bruce
Printz, Jeffery Gerald
Richards, Norman Purnell
Schafer, Stewart Edward
Seaton, Antonette Patricia | Seward, LaMar Alexander
Small, Jeffrey Cleva
Smith, Scott Ernest
Somerville, Philip Boyd
Stark, Wayne Robert
Thomas, Mason Bruce
Tsang, Calvin
Waite, David Jacob
Wellmann, Roger Ian |

ELECTRICAL ENGINEERING

| | | | | |
|-----|---|--|--|--|
| PhD | Kumar, Ashok | Raina, Gokal | Salami, Momoh Jimoh Eyiomika | |
| MSc | Campbell, Kevin John Maclean
Chow, Yuet-Sun | Grove, David Eugene
Koskovich, Gregory Nicholas | Onwuachi, Anthony Okechukwu
Zelenka, Kenneth Ricky | Zhang, Jie |
| Dip | Poscente, Sandro Priamo | | | |
| BSc | Abdulla, Aman Ismail
Abraham, Alan Richard
Andersen, Kim Boomer
Asquin, Donald Charles
Balston, Bruce Grant
Bell, William Myron
Bergman, Dale William
Billingsley, Richard Joseph
Blair, Richard David
Brailwaite, Richard Neil
Brown, Douglas Stewart
Buckland, Kenneth Michael
Burton, Mitchell Gordon
Chan, Boon Par
Chan, Michael Wing-Kwan
Chan, Wing Chiu
Chetib, Solomon
Christe, Diane Margaret Lenfesty | Chun, Tsz Kin
Cormer, Douglas James
Dale, Gordon William
Dehier, Glenn Bernd
Derkitt, Timothy Joseph
Dick, Gregory James
Duce, Shawn William
Foo, Samuel Shang-Suan
Fowell, Deborah Anne
Fowlow, Timothy John
Gnam, Warren Roland
Grasby, Robert John William
Harding, Kendall Leonard
Healey, Caroly Stewart
Hladik, Timothy Dean
Hsu, Daniel Tai Siang
Irwin, Timothy Lyle
Jones, Kevin Lindsay | King, Gordon Ralph
LaFranz, Jeffrey Lorne
Lam, Oi King Ella
Lam, Wah-Cheung Wilson
Lau, Kenneth Kin-Chuen
Lee, Joseph Dim-Wu
Li, Chun On
Lundy, Bruce Ross Colin
Mawdsley, Marilyn Jane
McCartney, James Schofield
McCready, John Randall
McDonnell, Deborah Ann
Mitchell, Donald Keith
Murray, Thomas Peter
O'Leary, John Willis
Olson, Robert Mark
Otto, Ross Allen
Paviack, Donald Bruce | Paynter, Gordon James
Phillips, Nelson William
Robertson, Wallace Ricky Alexander
Saar, Werner Michael
Shaw, Dwayne Erik
Sparling, Lawrence Alan
Springhetti, Rodney Peter
Stewart, Sheila Yvonne
Thurm, Randall Walter
van Schoening, Karen Ottone Ellnor
Warrior, Velvet Dawn
Winstanley, Robert Ronald
Wong, Kwok-Leung Ken
Wong, Tobey
Yu, Alex Lin-Kuen |

MECHANICAL ENGINEERING

| | | | | |
|-------------|---|---|--|--|
| PhD | Olorunmaiye, John Adesiji | | | |
| MSc | Lam, Hoi Tung
Molnuk, Halina Urszula | Orisamolu, Irewole Raphael
Poon, Yiu Cheong | Thom, Robert Martin
Woo, Charles | Yememi, Venkata N Prasad
Yu, Wei Keung |
| MEng | Bandali, Ainoor Nurdin | | | |
| BSc | Acteson, William Henry
Adair, Douglas Lloyd
Adams, Stewart Winfield
Banks, Alan Henry
Berghs Jr, Peter Andre
Bertels, Markus Conrad
Bily, Brent Charles
Brown, Iosif Dixon
Brown, Royden Winter
Bryant, Ron Rodney
Byers, John Nelson Christian
Carroll, Andrew William
Chow, James Hon Chak
Chow, Ronald Ernest
Chung, Siow Kong
Chung, Timothy Taemo
Cohen, Laurence William
Collins, David MacKenzie
Cullen, Christopher Keys
Daniel, Stephen Daryl | Davis, John William Harford
Dixon, Christopher James
Docherty, Shelley Dawn
Duke, Peter Smith
Edgington, Patrick Arthur
Finnestad, Scott James
Fox, Kathleen Mary Yarnell
Frazer, Geoffrey Clive
Gair, Scott Duncan
Geppert, Eric Carl Johannes
Gunn, Lawrence Arnold
Harris, Kevin Peter
Harrison, Michael Kenneth
Hawkins, Colin Glenn
Healy, William Joseph
Hicke, Darrell August
Kapusta, Stephen Anthony
Kernick, Franklin John
Kessler, Gerty Edward
Klaver, Louis | LeBlanc, Adrien John
Lundberg, Peter Charles
MacDonald, Ronald Hugh
Marshall, Jada Sheri
McClement, Glenn Morrison
Milner, Zalman Robert
Nawolsky, Jeffrey John
Morton, Garry Patrick
Ohlhauser, Keith Wayne
Olafson, Ami Wayne
Partridge, Janis Elaine
Pavan, Robert James
Perrott, David Brian
Peters, Kent Enroll
Pisio, Derek Lincoln
Plummer, Carol Annette
Poon, Barry Chi Hung
Rattan, Daljit Singh
Razniewski, Maciej Jan
Reimer, Barry Brian | Retzer, Hoi Otto
Rogers, Lawrence Edward
Rusted, Bruce Douglas
Sakai, David William
Schopp, John
Scott, Earl Patrick
Seetai, Gurjit
Shaw, Jeff Richard
Sakora, Rodney Patrick
Speirs, Brian Charles
Springer, Winston Arthur James
Sproule, Glenda Dawn
Steele, Robert Charles
Stuchly, Michael Jacek
Symborski, Donald Bruce
Vander Elst, Bradley Paul Joseph
Zacharia, Zach George |

SURVEYING ENGINEERING

| | | | | |
|-------------|--|--|---|---|
| MSc | Bulfeet, Bruce Allen
Buyong, Tahir Bin | Feuchtwanger, Martin
Mackenzie, Andrew Philip | Wanless, Brent Alan | |
| MEng | Ayers, Henni | | | |
| BSc | Allen, Dianne Elizabeth
Browett, Darren Gregory
Chu, William Ngai-Fung
Granlin, Iain Deryck | Hauff, Terry Walter
Hlasny, Bradley Steven
Hoerburger, Eric Anthony
Jones, Gary Stewart | Lau, Hoi-Keung
MacDonagh, Alan Francis
Moss, Darwin Lyle
Partridge, Steven Scott | Pointon, Kent Whitfield
Prevost, Mark Daniel
Ratcliffe, Carol Mary
Reiners, Daniel Franz |

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CHEMICAL ENGINEERING

| | | | | |
|-------------|--|---|---|--|
| PhD | Trebbles, Mark Alexander | | | |
| MSc | Englezos, Peter
Gupta, Anup Kumar | Irvine, Guillermo Antonio
Kammann, Marlene Gail | Leung, Raymond Wei Kwong | |
| MEng | Birkholz, Robert Kar Otto
Ferguson, Frederick Reginald Scott | Gngg, Murray William
Hazell, Evan James | Huang, Yung-Hwa
Lim, Thin-Hock | Sheldon, Darlene Anne
Yang, Joseph Mo-Tai |
| DipI | Nguyen, Hoai Bac | | | |
| BSc | Au, Sam
Bakes, Philip Anthony
Berg, Bruce Kennedy
Betts, James Alexander
Cole, Jeffrey Ernest James
Der, Danny
Dewji, Almqooner
Driscoll, Neil Howard
Edgerton, Homer Samuel
Eng, John Harvey
Fradenck, Daniel Edward
Galitsky, Randall James
Garg, Anju | Girvitz, Ronald Scott
Hami, Ali Karim
Harrison, Terry Clayton
Havenga, Leonard Duane
Ironside, Rick James
Jackson, Thomas Randall
Jaggard, Randall Thomas
Jiwani, Hanif
Johnson, Linda Marie
Johnson, Stephen Thomas
Kamm, Nicholas Earls
Kerr, Randall James
Keys, Patrick Michael | Leong, James Wah
Lutes, Byron Curtis
Martin, Paige Lianne
Maxwell, William Gregg
McLean, Allison Lee
Muir, James Ridley
Nighswander, John Allan
Olson, Kendall Jon
Ong, Tee Sing
Pattinson, Scott Edwin
Pon, Gaiu Fou
Praught, Timothy Leonard
Pryde, Collin Darren | Ross, Kenneth Bartholomew
Scarth, Daniel Gordon
Schneider, Gregory Nickolas
Seto, Johnny Dent
Stuart, Joan Carol Pardell
Tatz, Thomas Norman
Titcomb, Christopher Marc
Jikramatz, Paul Thomas
Varadarajan, Srinivasan
Virginillo, Cameron Bruce
Wichert, Martin William
Wong, David Kuo Hin
Wong, William Lung-Yiu |

CIVIL ENGINEERING

| | | | | |
|-------------|--|---|--|--|
| PhD | Chiestar, Jack Douglas
Maes, Marc Altons | O'Brien, Eugene John
Seif, Samir Philip Atalla | Sun, Venkata Krishna Mohan Rao | |
| MSc | Balesundaram, Andrew Chitranjan
Maher, Patrick Gerard | Siroshi, Sadanandan Neelamb
Taneja, Rajesh | Tsoi, Helena Miu-Kwan
Wall, James Stephen | Wijeratne, Ajith Buddhikantha
Wu, Ka Hung |
| MEng | Kwan, Yet-Man | Westhoff, Dennis Ronald | | |

Dipl Kaushal, Rakesh Kumar

BSc Bagozzi, Gary Raymond
Bork, Peter Roland
Buick, Richard Alan
Campbell, William Murray
Chan, Man Kwong William
Chan, Merak Wan-Kaung
Consul, Harsh Chandra
Dnedger, Thomas Ryner
Eng, Warren
Gallant, John Charles
Geleta, Richard Kelly
Gillott, Fiona Jane
Hedayat, Tarek G

Hullock, Todd Jay
Jaska, Kimberly Dawn
Kerr, Douglas Ralph
Kryczka, Mark Lorne
Kumangwana, Collins Korres
Kundert, Jeffrey Edward
Lee, Christopher Lin Paul
Lee, Jong Mar
Jenn, Edward Ray
MacMillan, Walter Shaw
Mayer, Sylvain
McCormick, Kerry James
Morogole, Sealla Lemohang

Morros, Nuna Emilia
Morton, John David
Mthini, Adrian Allison
Oness, Marley John
Palumbo, Claudio
Pedersen, Dwayne Christen Siak
Ramanathan, Nitharaj
Roque, Roberto Carlos
Rutherford, John Howard
Sellers, Anthony Johannes
Schaaile, Michael Allan
Schmidler, Michael George
Singh, Harbinder

Sitter, Beverly Ann
Solberg, Thor William
Stocker, Monica Claire
Sveinsson, Thomas Norman
Taylor, David Drew
Thong, Daniel Kooi Hock
Toh, Eng Chai
Too, Hing Seng
Wiegala, Gordon Michael
Wise, John Russell
Yakymyuk, Michael Brent
York, Steven Edward

ELECTRICAL ENGINEERING

PhD Cheng, Shi Jie

MSc Adamson, Richard Joseph
Agarwal, Anjali

Dipl Sharov, Boris

BSc Aldridge, Kenneth Craig
Block, Edward William
Bond, Gregory William
Boutin, Joseph Benjamin Mathew
Bowden, George Thomas
Bron, Alan Ernest
Carson, Megan Leigh
Chamberlain, Colin Brent
Chan, Gary Kwok Ho
Chan, Samuel Nai-Hi
Chapuma, Mavuto Joseph Frank
Choudhury, Ashtaq Ahmed
Concina, Stephen
Cook, Clive George
Crows, Stephen Watson
Devchand, Kashyap
Erfanian, Javan Ahmad
Frank, Edgar
Fu, Chi-Ping

Boyd, Jeffrey Edwin
Colpitts, Donald James

Funk, Garry Duane
Ginter, Thomas Stephen
Gordon, Cecil Edgar
Gurtler, Patrick James
Halton, Lorna Mary
Hetherington, Darrin Ray
Hilton, Alan Thomas
Hon, Timothy Chi-Hung
Howell-Fellows, Dean Marshall
Hsia, Daniel Jeng
Huddleston, Paul Thomas
James, Timothy Robin
Jewitt, Jeffrey Carver
Johnson, Richard Andrew
Kalke, Catherine Lynn
Kee, Esther Chuen-Chun
Kuchinka, Bradley Allan
Kuhnlein, Roy Steven
Kveps, Andris Alexander

Fajokuwo, Abraham Olafunji
Knapp, Paul Lawrence

Kwan, Manford
LaMarre, Gregory James
Lau, Kin-Hung Hillary
Lee, Jason Winfield
Lee, Jing
Lee, Michael Robert
Leong, Glenn Lock
Lien, Warren Arthur
Loch, Warren David
Loman, John Frederick
Mak, Eric Hon Wai
Massey, Darren Rene
Moghadam, Michael Vincent
Newman, Robert Ear
Ng, Ping Fai Roy
Nguyen, Hien Ngoc
Oakley, Christopher Leigh Michael
Petersen, David Joseph
Powell, Todd Alexander

Oberhammer, Wolfgang
Orbay, Hakan

Smit, Theodorus Johannes
Stafford, Clayton Douglas
Swab, Lyndon William
Tang, Simon Shu Ki
Tardiff, Dale Dennis
Thessen, Brian Jacob
Tsay, Yun Winston
Turner, Thomas John
Vanro, Paul Mark Alexander
Webb, Duane Kevin
Webb, Michael
White, James Perry
Wong, Norman Chow
Wray, David Glen
Wright, David Bruce
Yeske, Corinne Alice
Yeung, Roger Kim-Leung

MECHANICAL ENGINEERING

MSc Alves, Paulo Santos
Chan, Pak-Kin

MEng Chan, Mark Yuk Sun

Dipl Candadar, Ramesh Sundarvardan

BSc Albertsen, Thomas
Allan, Brian Robert
Bains, Gurdev Singh
Balleke, Hugo Heller
Blum, Michael Gerhard Gustav
Bratton, Rodney Allan
Braun, Bradley James
Butt, Andrew Macdonald
Chang, Ching-Wen Anna
Chao, Shiu-Kai
Choo, Charles
Chui, Jack Ngai-Shing
Ciurysek, Glen John
Ciurysek, Harvey George
Corrains, Gerald Glen
de Villenfagne, Robert Paul
Diocee, Tapindai Singh
Dyck, John Gerald
Dye, Dale Geoffrey
Easterbrook, Cy Bruce

Cheng, Henricus Tai Kwong
shola, Ganiyu

Chiu, Wai-Lim William

Engman, Randy William
Ferrai, Stephen Andrew
Forgach, Ted William
Greenfield, Alan Harold
Guzzardi, Riccardo Demetrio
Harapiak, Allen Charles
Henderson, Ronald Laurie
Hughes, David Alan
Janssen, Neil Ingo
Jung, Judy
Kapesi, Roy Hamilton
Kappelhoff, Gordon Herman
Larsen, Daan Gunnar
Lee, Myron Garth
Leong, Henry
Lo, Anthony
Magyar, Bradley Stewart
Marshall, Dale Robert
Martens, Kendal Peter
McCarthy, Michael Todd

Le, Phong Xuan
Mehta, Sudarshan Arvindbhai

McNeill, Glen Norman
Miller, David Bruce
Morrison, Robert Ralph
Murdoch, Kevin Robert
Ng, Joseph Wai-Siu
Olaison, Dean Arthur
Owen, Gareth David
Phillips, Ian James
Rama, Robert William
Rasmussen, James Peter
Rasmussen, Jan Aksel
Rempel, Doreen Grace
Rodrigues, Joseph Ivan
Ross, Allan Edward Felix
Ross, Brian Douglas
Ruus, Alexander Harry
Ryhorski, Mark
Schalkoski, Lana Louise
Shopperly, Terrence Eugene
Smink, Bernard Frederik

Molnuk, Roman Wojciech

Sood, Hersh
Spiegelmann, Brian Eric
Sterner, Anthony Joseph
Tahmazian, Phillip
Tam, Danny Chung Kin
Tam, Danny Ming Wai
Taylor, Colin William
Tran, David Viet Dang
Turcato, Oscar Silvio
Turiski, Richard Edgar
Turiski, Robert Kasi
Jinguhart, Kenneth James
Van de Panne, Job Sebastiaan
Vissai, Kenneth Dale
Volcko, Michael Dean
Weiss, Marvin Harvey
Wickenhesser, Dale Kenneth
Wu, Andrew Yau Wai
Wright, Sydney Steven
Zegien, Peter John

SURVEYING ENGINEERING

PhD Vassiliou, Anthony Andrew

MSc Gareau, Rene Marcelin

Wok, Ah Loy

BSc Bossenmaier, Steven John
Chong, Ian Glen
Dahms, Bruce Patrick
Gunn, Robert Morrison

Hall, Ronald Owen
Main, Allan Robert
Martin, Monty Ray
Milne, James Duncan

Ratchinsky, Kelly William
Riecken, Robert Kellow
So, Alan Kam-Lun
Stevens, Douglas Theodore

Tremblay, Kelly John
Turnbridge, Allan William
Williams, Stephen Peter

1987

CHEMICAL ENGINEERING

PhD Belgrave, John David

Kokai, Sunil Lakshand

Rastogi, Ashutosh

Sibbald, Laurie Roy

MSc Jamaluddin, Abul Khair Muhammed
James, Neil Edward
Koon, Darren Wai Hong

Linardos, Theodoros Ioannis
Oballa, Viera
Papathanasiou, Athanasios

Patence, Gregory Scott
Rajan, Firdaus Shahabuddin
Xu, Kejia

MEng Johnson, William Edwin
Kenny, James Anthony

Mohamed, Ibrahim
Myer, John William George

Richardson, David Kenneth
Thimm, Harald Friedrich

Yeung, Wun-Bing Selina

DipI Chow, Chiu Chun

Kabalek, Peter

Kavanagh, Paul Thomas

Nadim, Ahmed Mohamed

BSc Abdel Malek, Hani
Allen, Nicholas Gibbons
Barrow, Jonathan Mark
Berscht, John Douglas
Bjerkseth, Joseph Kent
Boudreaux, Don Allen
Brousseau, Patrick Richard
Chin, Albert Man Hung
Chitick, David William
Coffey, Kathleen Jane
Delaney, Darcy Dan
Dlugogorski, Bogdan Zygmunt
Doherty, Eugene Jewellyn
Eastick, Robert Roy
Farkas, Vincent Louis

Forster, James Brent
Geeraert, Douglas Bernard
Georgousis, Zoe
Gingulis, Sam Socrates
Hilzroth, Alan Joseph
Ho, Anne Nannette Jy
Holuk, Michael Ross
Hughes, Trevor Lane Arthur
Janzen, Marlene Yvonne
Johnson, Kar Blaine
Jones, Brent Jordan
Kerber, Carol Darlene
Kromm, Robert Bruce
Law, Lucas Kwang Tai
Longhurst, Gary Sidney

Lui, John Ming Ho
MacKinnon, Catherine Joan
Marsh, John Curnins
Martin, Brian Thomas
McMillan, Kenneth Bain
Micheal, Hany
Miller, Laura Jane
Minions, Peter Stewart
Monnery, Wayne David
Palmere, Malcolm John
Pastoris, Paolo Giancarlo
Pannacchioli, Enzo David
Rancier, Darcy Wayne
Rendall, Edward Osborne
Rippe, Michael Joseph

Sah, Shalini
Schaefer, Warren Randy
Sharp, Alan David
Shawa, Sabir Monzer
Stavroulakis, Dimitrios Angelos
Stellwell, Michael Douglas
Strong, Jeffrey Blair
Takenaka, Lisa Lana
Telarenko, Pamela Karen
Tudor, Eric Hughson
van Son, Kerry John
West, Suzanne Lee
Wan, Poh Hing
Wong, Dean
Yan, Wayne Chi Wa

CIVIL ENGINEERING

PhD El-Degwy, Wael Mohamed

Mokhtar, Abdelsalam Ahmed

MSc Ghonaim, Gamal Abdel-Aziz M
Konecny, Ladislav
McEnnis, Duncan Arthur

Pomeroy, Stuart John
Shafila, Marwan Mohamed
Sing, Victor Sau Kin

Srinivasamurthy, Kempiah
Wong, Calvin

MEng Dietrich, Edward Anthony

Lee, Frederick Shu-Shue

Tju, Chin Kee

BSc Aitken, Colin Robert
Anderson, Denise Linda
Bain, Garry James
Balker, Adrian Peter
Beaupre, Fredrick Paul
Bonner, Marc Peter
Brice, James Richard
Butler, Karen Leah
Chui, Jo Jimmy Chi Yia
Chung, Chungma

Clarke, Thomas James
Costerton, Robert William
Dahi, Richard Herbert
Daikwa, Canace Nycele
Fox, Jeffrey Allan
Freudenthaler, Mark Peter
Fung, Ken Mou-Kuen
Geib, Jerrold Arvid
Goldade, Bravin Joseph
Helton, Steven Dale

Kruger, Peter August
Kusen, Steven Nick
Lapointe, Jacques Pierre
Leteta, Stephen John
Mackenzie, Russell John
McLeod, Robert Geoffrey
Pardoe, Glen Andrew
Pasquini, Antonio
Pennell, Randal Scott
Potras, Andre Joseph

Romenman, Patrick William
Rowland, John Murray
Sikuea, Tipitoma Ota-Ki-Muli
Singhail, Timothy Edwin
Taylor, Angela Cruz
Thomson, James David
Veeland, Allen James
Walker, Vince William Norgate
Weavell, Alan John
Wong, Darryl

ELECTRICAL ENGINEERING

PhD Chandra, Ambrish

Walkley, David Jonathon

MSc Chaudhri, Subhasis
Clarke, Edmund Edwin
Itani, Abdul-Kader

Li, Chun On
Mitchell, Donald Keith
Nichols, Stacy William

Ramesh, Babu Krishnasasthy
Tan, Alice Siew Lian
Wong, Kwok-Leung Ken

Wong, Raymond K.

MEng Evoy, Derek Franklin

Stubblings, Randall Victor

Wickel, Patricio Eugenio

BSc Alam, Jasbir
Alam, Kamal
Albrecht, Curtis Ranier J E
Araya, Kassa Tesfai
Bauer, John Michael
Beuentein, Brian Edward
Bowron, Jeffrey Dale
Burke, James Alexander
Bush, Cameron Malcolm
Carr, Timothy Michael Hughes
Cellars, Blain Edward
Chan, Anthony Chi Ming
Chow, Alexis Kwok Wai

Clark, Geoffrey Blair David
Cottam, John Arthur
Cotterill, Barbara Anne
Cottingham, Robert William Paul
Danser, Brian Albert
Davies, Robert James
Demosky, Vincent Myles
Dickle, Douglas Brock
Dmitrova, Robert Walter
Dykema, Henry John
Eggerton, William Richard
Falkenberg-Andersen, Christian
Flemming, Douglas Wayne

Fong, Raymond
Foog, Wilson Kang Ching
Fung, Kevin Jik Yan
Gauthier, Alice Diane
Gray, Allan Ambrose
Hamann, Gilbert Ewald
Hammond, Michael Edward
Harlow, David Ross
Hinh, Phuc Buu Eric
Issler, Richard Wayne
Jensen, Michael Erik
Lam, Wai-Kin
Lang, Darryl Edwin

Lau, Michael Hang Cheung
Lau, Sophie Shuk-Yee
Lautermilch, Douglas John
Le, Dung Tan
Lee, Ackham
Lee, Peter Wing
Levinson, Brent Paul
Levstik, Andy Peter
Li, Hoi Tat Aaron
Loh, Felipe
Mack, Corey Dean
Mah, Timothy Calvin
Martin, Paul Edwin

| | | | | |
|------------|--|---|---|---|
| BSc | May, Gordon Andrew
McFadzean, David Bruce
McPhail, Stuart Colin
Michaud, Elaine Marie
Miu, Irene Chi-Fong
Morcos, Anthony George
Ngo, Yanton
Nguyen, Quoc Thai
Nicholas, James William | Nordquist, Scott Edwin
Petersen, Dean
Poon, Chester Chi-Keung
Prokopiuk, Karlos Quentin
Rafusa, Martin Douglas
Reeson, Robert Glen
Schoeggl, Viktor Johann
Schuler, Vaughn Gordon
Sefmoun, Abdolreza Homayoun | Shaw, John Leonard
Shaw, Kevin Christopher
Ske, Douglas Jordan
Smith, Richard Lloyd
So, Chun-Sing
Spinney, Andrew Wayne
Sleedman, Andrew Clifford
Ta, Van Trung
Tennant, John Keith | van de Panne, Michiel
Wheatley, Miriam Margaret
Wilson, Michael Blaine
Wong, Raymond
Yeung, Chiu-Wah Bartholomew
Zanewich, Mary Joanne |
|------------|--|---|---|---|

MECHANICAL ENGINEERING

| | | | | |
|-------------|--|--|---|--|
| PhD | Aydemir, Nusret Jiguran | Kibria, Mohammed Goleim | Sahin, Ekrem | Schlaepfer, Johannes Fridolin |
| MSc | Aives, Heloisa Santos | Jameel, Mohamed Ishaq | O'Brien, Matthew Jon | |
| MEng | Druhall, John Lawrence Blaine | | | |
| BSc | Aitken, Kathleen Anne
Bach, Ivan
Baggott, Ian Henry
Bartkiewicz, Andrew Samuel
Berg, Kenneth Andrew
Belts, Bryan Anderson
Blair, Karin Anne
Briggs, Patricia Ann
Brown, Robert James
Carlson, Jonathan Drew
Carpenter, Ricky Albert
Caswell, David John
Cellars, Brian Willis
Clarke, Jeffrey Scott
Costello, Harold James Donald
Dahi, Clifford Reed
Dalglish, Kevin Lloyd Wesley
Danyluk, Tamara Lynn
Edwards, Timothy Garry | Fandry, Shane Lloyd James
Feighan, Patrick Joseph
Fincati, Anne Marie
Franka, Joseph
Freaborn, David Dean
Gittins, Simon David
Goldsmith, Peter Brian
Green, David Albert
Harbert, Nancy Eileen
Helmer, Gregory Lawrence
Hurd, Stephen Douglas
Jipp, Gary Victor
Jones, Garth Eldon
Klemptner, Martin Senold
Koladia, Shamez
Kraft, Christopher Lee
Laung, Peter Elick
Lakhdhir, Aminmohamed Manji J
Lam, Kenneth Fu-Keung | Lee, Edward Kwok Leung
Leimer, Kenneth Ludwig
Lassing, Thomas Eduard
Lim, Victor
Mackie, Douglas Stuart
Marecek, Andrew William
Mason, Brian Wayne
McManus, James Michael
Meyer, Darcy Clifford
Morrin, Mark Philip
Mowchenko, Murray Allan
Nowlin, Guy Alan
Paauw, George
Palmer, Blayne James
Pearson, Darren George
Platt, James Fredrick
Pollard, Peter Robert
Rainville, Pierre
Ritchie, Brian Douglas | Roseworn, Jeffrey Stewart
Ross, John Anthony
Schaefer, Kurt Allan
Schmidt, Gordon Dale
Schumacher, Roy Hermann
Smith, Stanley Andrew
Spot, Virginia Anne
Stewart, Jeffrey Nelson
Thomson, Robert William
Tornie, Daniel Roy
Torvi, David Andrew
Truong, Allan Duy Hung
Jpligrove, John Walter
Van Sickle, Gary Peter
Wager, Kelly Floyd
Wong, Ronald Leonard
Yamada, James Michael
Yung, Gerald Si Yun
Yurkowski, Todd Kenneth |

SURVEYING ENGINEERING

| | | | | |
|-------------|--|--|--|--|
| PhD | Paine, Steven Hugh | | | |
| MSc | Cannon, Margaret Elizabeth | Goldfarb, Jay Michael | Mulaku, Galcano Canny | Thyer, Norman Harold |
| MEng | Hagglund, John Edward | | | |
| BSc | Allen, Gary Car
Archer, Paul Anthony
Barnett, Bruce Alan
Bayly, Donald Andrew
Broeren, Peter Ian Martin
Crape, Caroline Frances | Csupak, Rezo Arpad
Des Roches, Daniel Eric
Friessen, Gerhard Charles
Gaudreault, Francis Marcel
George, James Russell
Harris, Clyde Bradley | Hendry, Richard Glynn
Huff, David Roy
Kempe, Andrew Benjamin
MacLeod, James William
MacPhee, Janet Rhoda
Martell, Hugh Earl | Mitchinson, Donald Bruce
Parker, Brian Fred
Pettersen, Leland Lyle
Scott, Robert Walter McGregor
Tam, Ashley Pui |

1988

CHEMICAL ENGINEERING

| | | | | |
|-------------|--|--|--|---|
| PhD | Chung, Keng Huat | Simandi, Iana | Stocker, Rudolf Conrad | |
| MSc | Asante, Benjamin
Baah, Charles Acheamfour
Eng, John Harvey | Fairburn Wallace, Judy Ann
Forestell, Sean Patrick
Goulet, Daniel | Hassam, Mohamed Shamshudin
Monney, Wayne David
Ong, Tee Sing | Sugianto, Satiahardjono |
| MEng | Balachandran, Murali
Beckie, James Kenneth | Da Se, William Joseph
Huntrods, Richard Stanley | Mannhardt, Karin
Mascarenhas, Audrey Maria | Verge, Alexander Gerard
Wee, William |
| Dip | Jamai, Ainoor Hassanali | | | |
| BSc | Alig, Christian Joseph
Balycky, Roderick Panko
Bell, David Richard
Bell, Marilyn Elhai
Bohme, Gerald Edward
Côté, Denis Jean
Deaver, Janet Lynne
Doug, Tracey Carole
Fawcett, Thomas Ian
Forrest, Thomas Joseph
Foscocos, Elias
Fung, Jim Pui | Gill, Baldev
Godard, David Cenydd
Graham, Kerry Ann
Hall, Kenneth Hubert
Hogan, Robert Carey
Johnson, Glen Howard
Klassen, Andrew Peter
Lam, Wah Chung Leuler
Lata, Edward Henry
Lee-Wing, Samie
Liebe, Harald Randolph
Lloyd, Paul James | Lorette, Kewn Peter
Luu, Tan Quoc
MacDonald, Robert Allister
McPhail, Jeffrey Thomas
Ngo, Phung Hue My
Nielsen, James Anthony
Noble, Ian Mackay
Northcott, Robert William
Novak, Nina Vera
O'Connell, John Patrick
Oelke, Harvey David
Olmstead, Douglas Edward | Piera, Jacob Johannes
Rechai, Denise Nadine
Sauve, Robert Edward
Slipp, John William
Stepanic, Daryl Warren
Thorp, Julie Christine
Tse, Cecilia Wan-Kam
Welsh, Kevin Robert
Weninger, Peter Hans
Yano, Diana Mitsuko
Young, Mark Graham |

CIVIL ENGINEERING

| | | | |
|-------------|--|---|---|
| PhD | Lam, Tack Choon | Vogendran, Velupillai | |
| MSc | Czarnecki, Bozena
Finnigan, Corey | Rauhut, Angela Christine
Rutherford, John Howard | Saretsky, Kevin Patrick
Seneviratne, Pinnagodage Asitha R |
| MEng | Enslin, Peter Michael | Gimesy, Mana Anna | Lipowska, Elzbieta |
| Dipl | Holden, John Duncan | | |
| BSc | Benins, Catherine Edith
Bergeson, Kelvin Rae
Bily, Linda Ann
Cameron, Al Jack
Campbell, Richard Alexander
Davies, Colin William Graham
Derksen, Michael Lawrence | Fandry, Carla Gayle
Figueira, Vaughn Celso
Gabel, Richard Alan
Hillier, Scott Wayne
Ho, Man-ka Simon
Kirmaier, Horst Georg
Kiebaum, Thomas Edward | Lekstrom, Marilyn Patricia
Lau, Ryan Kwong Yuen
Mah, Dana Joseph
Mah, Leon Tang
Maimel, Bernard Paul
McFarlane, James Douglas
McGowan, Clive Murray |

Melnik, George
Roberts, Michael Scott
Tan, Igo Thay Gwan
Willis, Kevin Gilbert
Wierzb, Carl Harry

ELECTRICAL ENGINEERING

| | | | | |
|-------------|--|---|---|--|
| PhD | Mahana, Pram Nath | Obadina, Oladiran Olugbolahan | Pahalawaththa, Nalin C | Zhang, Jie |
| MSc | Chan, Boon Par
Chebib, Solomon
Fowler, Timothy John | Green, Brian Douglas
Hon, Timothy Chi-Hung
LaFrenz, Jeffrey Lorne | Lau, Kin-Hung Hillary
Lee, Ling Steven
Pastawski, Daniel John | Soukara, Anwar Mohamad Farid |
| MEng | Pai, Zsigmond Miklos | | | |
| BSc | Abraham, John Edward
Allan, Kevin Young
Austin, Jahangir Erach
Bachelot, Roderc William
Bennet, Edward Robert
Brown, John Allen
Burns, Gregory Keith
Calicuw, Robert John
Chan, Yuk Sing
Chau, Tuyen Thanh
Corst, Angela
Dabic, Milan
Dan, Winsor
Doerksen, Robert James
Doll, Ian Peter
Douglas, Geoffrey Todd
Evelyn, William Hilton
Gholamian-Langaroudi, Mohammad | Gibson, Andrew Fraenkel
Glaser, Edward Paul Henry
Harper, James Robert
Heinrich, Lance
Huyfah, Ling Chieu
Jamieson, Robert Ian
Jorgenson, Ryan Dale
Kellner, Trevor Scott
Kurrant, Douglas John
Kwok, Yiu-Chung Duncan
La, Hung Yi
Lam, Francis Loi Yi
Lam, Michael Shui Kam
Lee, Chun Ho Arthur
Li, Kin Cheong
Li, Thaddeus Su-Por
Liu, Pak Lon Paul
Lo, Yuen Hei | Madsen, Jeffrey Peter
Mah, Andy Gin
Mathews, Tilus
Newman, George Lavern
Ng, Ching Yi
Nguyen, Nam
Nguyen, Nhan Thanh
Nguyen, Tai Huu
Oostra, Mark Henry
Peters, Terry Charles
Pham, John Chau Hong
Platt, Ronald Scott
Poon, Wai-Tat Peter
Purkis, John Stewart
Rahim, Shabriz Badr Idin
Rea, John James Mitchell
Ready, Lee Allan
Richardson, Randall Andre | Rodgers, Patrick Sidney
Sachy, Thomas Hewitt
Shum, Raymond Wai Man
Sullivan, Douglas James
Svihura, Michael Joseph
Tamayo, Edgar Carlos
Trac, Hong Ung
Tran, Hugh Iy Dinh
Tran, Phat Manh
Tran, Quang Dinh
Tremaine, Dean Gordon
Vivanco, Gonzalo Fernando
Vo, Hien Xuan
Vollmerhaus, Andreas
Wang, John I-Chung
Williamson, Robert Scott
Yan, Seow Chiang |

MECHANICAL ENGINEERING

| | | | | |
|------|--|---|--|---|
| PhD | Orisamolu, Irewole Raphael | | | |
| MSc | Ballas, Leszek
Bull, Andrew Macdonald | Chin, Ching-Fall
Jayasinghe, Demuni Mudilha | Jansen, Lawrence George
Rattan, Daljit Singh | |
| Dipl | Staniland, John Edward | | | |
| BSc | Amann, Michael Eduard
Ang, Boon Tong William
Beatty, Layton Wayne
Berg, John Gunnar
Bertocchi, David Vladimiro
Bhura, Alnoor
Brown, Lindsay John
Cameron, Clifford William
Connors, Douglas Robert
Coulthard, Alexander Bruce
Currie, Ian Robert
Enser, Gregor Mathaeus
Funk, Cindy Michele
Goodchild, James Robert
Graham, Robert Leonard
Heslop, Darren Charles | Horsley, David James
Hughes, Gary Edmund
Hui, Wayne Wai Chung
Hunka, Marcella Marie
Janssen, Charlotte Ann
Jasper, Ingrid Anita
Jeyachandran, Arun Mark
Johnson, Dean Michael
Juan Jr, Alejandro Alito Jose
Keith, Dylan Grant
Kries, Kenneth Anthony
Lee, Andrew Gordon
Li, Chick Hung Barry
Lui, Jimmy Ming Kai
Lundberg, Ian George
Lunn, Ralph Matthew | Masterson, Scott Glen
McKone, Joel Edward
Mercier, Robert Francis
Mitha, Fayaz Akberali
Monaghan, Douglas Charles
New, John Michael
Nikforuk, Colin Francis
O'Connor, Joseph Albert
Powell, Kevin Cole
Raugust, Jeffrey Alan
Reimer, Keith Warren
Ritchie, John Berton
Schmidt, Ian
Serpas, Jaime Ernesto
Sheppy, Conrad Guy
Sjoberg, Brian David | Skarstov, Stephen Kent
Smith, Colin Matthew
Steffan, Christopher Ronald
Storoshenko, James Alexander
Sundberg, Michael Lawrence
Tan, Wee Thai Joseph
Thangwane, John Tshebo
Thompson, William Wilfred
Unold, Ian Vincent
Ward, Stephen Campbell
Watts, William Martin
Wierzbis, Andrew
Wilcock, Leah Joanne
Yee, Stanley |

SURVEYING ENGINEERING

| | |
|------------|------------------------|
| PhD | Siders, Michael George |
|------------|------------------------|

MEng Arden, Dale Arthur George

BSc Bains, Jaswinder Jessie Singh
Burnham, Patrick James
Cawte, Jeffrey Robert
Connatty, Darren Brian Christopher
Craig, Guy David
Fletcher, Roy Anthony

Gibson, Jeffrey Scott
Hamelin, Roger Joseph
Harvey, Glenn William
Hoerberger, Steven Robert
Ing, Alvin
Jackson, John Stewart

Le, Minh Thanh
Li, Siu Hong
Miche, Robert Gordon Ian
Plouffe, Daniel Terence
Robertson, Jeffrey Michael
Sansom, Brian David

Smyth, Gerald David
Sutherland, David Genji
Thompson, Michael Cameron
Wentzel, Jan Frederik

1989

CHEMICAL ENGINEERING

PhD Nighswander, John Allan

MSc Bakes, Philip Anthony
Dholabhai, Pankaj Dhansukhlal
Eastick, Robert Roy

Gupta, Ram Bihan
Hossain, Muhammad Sabbir
Huang, Zhiming

Kohse, Bruce Frederick
Muir, James Ridley
Sengupta, Susmita

MEng Bilogzi, Diane Ethel
Fryett, David Edward
Hovdestad, Wayne Roy

Lai, Cassandra Ka Wei
McGee, Bruce Craig Wade
Mokrys, Igor Jan

Murchie, Kenneth Wayne
Scott, George Robert
Thornton, Richard William John

Yip, Lawrence Lin-Leung

Dip Jain, Sidharth

Marks, Gregory Augustine

BSc Alexanderson, Larry Kenneth
Baker, Michael Allan
Balasch, Jason Albert
Bibby, Robert Shawn
Bibendorf, Monique Suzanne
Bligh, Barry Robert
Byers, Stephen Donald
Castellino, Douglas Emmanuel
Chow, Tim San
Clifford, Stephen Richard
Douglas, Scott Robert
Edwards, Maurice David Thomas

Forteath, Robert Bruce
Hakimattar, Khalil
Hamilton, Deborah Anne
Hansen, Kevin Michael
Hansen, Michael Scott
Hem, Wayne Patrick
Iuliano, Michael Angelo
Jenkins, Dean Jay
Joshi, Nalin
Kadar, James Michael
Laszlo, John Janos Pal
Le, Young Wayne

Lighter, Lawrence Michael
Long, Kenneth Graeme
Lyons, Howard Charles
Madsen, Keith Edmond
Mealey, Willard Brent
Miles, Darwyn Ronald
Neumeier, Shawn David
O'Brien, Kerry Patrick Shayne
Perizzolo, Timothy Augusto
Petran, David Ian
Ritsch, Michael
Schmaltz, Calvin Lawrence

Seitz, Trevor Leslie
Spargo, Patrick John
Tran, Thanh
Jrner, Sharon Lynn
VanderPutten, Randall Hugo
Warholm, Robert Ralph
Wilks, Kevin Albert
Williamson, Kelvin Wesley
Wohlgascheffen, Kenneth Ralph
Wong, Chi Man
Wu, Josie Lisa
Zaharichuk, Sheldon Layne

CIVIL ENGINEERING

PhD Beersing, Anil Kumar

El-Badry, Mamdouh Mohamed A H

El-Rahman, Manai Mahmoud Abd

Griffiths, Frederick John

MSc Elliott, Eleanor Mary
Eng, Warren
Gillott, Fiona Jane

Jamieson, James Bruce
Konecny, Jana
Lewis, Carrie Marie

Martin, John David
Sparrow, David Gerard
Swenson, Thomas Norman

MEng Chow, King Nong

Freeman, Monica Claire

Jaska, Kimberly Dawn

Kawczynski, Mieczyslaw

BSc Brownlee, James Erling
Cooper, Brian Edward
Davidson, Martin John
Dancy, Dwight Evert
Kinyua, Julius Clement Thuku
Kwan, Edward Chi-Lum
Lallamme, Marie-Jose

Lee, Robert John
Leon, Luiz Guillaume
Musak, Douglas Murray
Newfield, Grant Rodrick
Ngo, Hoang Dinh
Pagenkopf, Ralf Erwin
Penter, Lawrence Gene

Quong, Victor Kenneth
Raine, Gregory William
Reiter, Jonathan Paul
Robertson, Travis James
Sehri, Manbhad
Serpas, Lidia Maria
Shumlich, Thomas Alexander Mark

Smit, Brian John Richard
Sprinkhuysen, Anthony
Jhryn, Kelsy Denise
von Schoening, Andrea Clara H
Wong, Stanley
Yusyp, Lewko Josef

ELECTRICAL ENGINEERING

PhD Fapojuwo, Abraham Olatunji

Wu, Qingli

Prakash, Keshav Surya

Wu, Jungshyr

MSc Bauer, John Michael
Choudhury, Ashfaq Ahmed
Gonnason, William Roy

Jorgenson, Mark Brady
Jeckie, Brian MacGregor
Rajakaruna, R Mohottu A S

Saar, Werner Michael
Smit, Theodorus Johannes
Winstanley, Robert Ronald

Wu, Xiwei

MEng Beatty, Ross Lloyd

O'Connell, Stephen Richard

BSc Ahuja, Kulvinder Kelly
Archer, Sean Nelson
Ayer, Jayanthi Bhasker
Beille, Leonard George
Brauer, Harold Dieter
Chan, Hon-Yung
Cheng, Tony Cruz
Chio, Chong-Man Paul
Chow, Jacky Tai-Ying
Chung, Lam Quoc
Code, Darren Andrew
Coulter, Thomas Gerald

Davis III, James Wilson
DeSouza, Hillary Anthony
Dorjee, Lobsang Khechok
Drew, Gregory John
Duong, Kent
Duong, Sinh Van
Elsaesser, Derek Shawn
Enns, Lonnie Scott
Essery, Thomas Jeffers
Ferguson, Richard Douglas
Funke, James
Gebhardt, Sven

Graumann, Peter John Waldemar
Greenfield, Glenn Murray
Griffiths, Mark Barrington
Grundmann, Lorne Robert
Henkel, Harold David
Harris, James William
Hengst, David William
Holt, Trevor Leigh
Hullah, Christopher Michael
Janson, Jan Willem
Ji, Andrew Xiang-Dong
Jones, Dennis Gordon

Josephs, James Nicholas
Key, Yuen-Ling Fara
Kirschenman, Wayne Elroy
Klukas, Richard Walter
Kosten, Michael James
Kuhn, Bradley John
Ladhani, Shamsi Sadrudin
Lai, Andrew Kai Wah
Lai, Neville Kwong Chee
Lam, Chun Wing
Lelung, Jason Ming-Shun
Ly, Hung

| | | | | |
|------------|--|---|---|--|
| BSc | Lytle, Gregory John
McGibney, Grant Howard
Michaud, Bertrand Marc-André
Motyka, Daniel Richard
Mountford, Clive Ian
Neumann, Jennifer Sheila
Ng, Ping Chung Anthony
Ng, Wing Kaung
Ngo, Thieu Anh
Nguyen, Hong Van
Nguyen, Quoc Hung | Nguyen, Su Kim
Nordh, Pernell Elvin Theodore
Patterson, Robert William Michael J
Poyhia, Richard Tapio
Radke, Timothy Shawn
Reso, Dale Frederick
Savard, Mark Murray
Scott, Rex David
Shaw, Neil Murray
Sirois, Denis Laurier
Smith, Anthony Hamilton | Stratton, Robert Paul
Swanson, Kevin Eric
Ta, Khuong van
Ta, Linh van
Tan, Swee Hu Clarence
Tom, Frankie Chun Keung
Trac, William
Tran, Philip Vi Quyen
Tulsi, Harrychand
Turgeon, Esther Mary
Walsh, Stephen Bruce | Willard, Grant Lloyd
Wilson, Bogard Bays
Wong, Dennis Yew San
Wong, Hong-Fong Tony
Wong, Tung Man
Worthington, Stephen David
Yeo, Lay Hong
Yu, Tony Tze Wai |
|------------|--|---|---|--|

MECHANICAL ENGINEERING

| | | | | |
|------|--|--|---|--|
| PhD | Al-Himyary, Thair Jafar Sadik | Bahlsen, Hermann Alexander | Vanmeulen, Stephen Owen | |
| MSc | Kyejo, David Thomas | Sternier, Anthony Joseph | Sun, Stephen Kam Sing | |
| MEng | Au, Dominic Kai-Ming | Goldsmith, Peter Brian | Szabo, Jason Leslie | |
| BSc | Arnell, Douglas James
Barham, Glenn Reginald
Barnes, Timothy Lee
Beckie, Noel Andrew
Been, Sijze
Bohme, Brennan Calvin
Bond, Douglas Quintin
Booth, Michael Peter
Boyd, Anthony John
Bradley, Michael Richard
Chaudhry, Zafar Iqbal
Chin, Mane Mei-Fung
Collado, Kenneth Hilmer Fontanilla
Crawford, Paul Richard
Dhillon, Kulwant Singh
Dunsmore, Isobel Terese
Edwards, Holly Jean
Farrell, Timothy Joseph
Flanagan, Colin Daniel
Gee, Stephen Yuen | Hajduk, Eric Andrew
Harvey, John David
Hindle, Stuart Lee
Hodgson, Gregory Henry
Holmes, Kenneth Wendel
Hugo, Ronald
Janjua, Mohammed Azeem
Jansen, Leo
Keung, Nelson Tak Lung
Kim, Chang Yul
King, John Robert
Knobbe, Keith Lloyd
Kowch, Ronald Paul
Kunkel, Thomas Robert
Kwok, Wai Choong
Lai, Wayne Wai Kwok
Le, Duc Vinh
Leslie, Colin Fraser
Li, Yip Shing
Longphoe, Jeffrey William | Mackie, Russell Dean
Mainwaring, Christopher Robert
Masuda, Jay Kenji
Mazzolani, Marco
McMurray, Kenneth John
McPherson, Roger Wayne
Mercieca, Raymond Francis
Michelin, John
Milbrandt, Murray Louis
Millard, Brent Raymond
Milligan, Darren Robert
Mortimer, David William
Mueller, John Alfred
O'Rourke, James Joseph
Orthner, Bradley Dean
Osadchuk, Lyle John
Paquette, Maurice Denis
Pedder, Lindsay Anne
Peterson, William Robert
Price, Glenn Robert | Ravenstbergen, John Edward
Rooney, Kevin Thomas
Roth, James Douglas
Runham, Blain Ernest
Sandberg, Paul Trevor
Schuh, Christine Karen
Screen, Kevin Craig
Stoddart, Thomas Jay
Stolz, Robert Douglas
Sutherland, John Joseph
Sutherland, Michael Thomas P
Tang, Shao-Shan
Theilgaard, Morten
Tom, Jimmy Chun Kuen
van Besouw, Theodorus Paulus J M
Warne, Ross Henry
Waslen, Douglas William
Wilson, David Kenneth
Wolff, Richard John |

SURVEYING ENGINEERING

| | | | | |
|-----|---|---|--|---|
| PhD | Mephum, Michael Patrick Arthur | Wong, Richard Yoon Choong | | |
| MSc | Biacs, Zoltan Ferenc
Klesh, Laurie Anne | Polinton, Kent Whitfield
Tang, Tony Chan Tung | Zhang, Guangyi | |
| BSc | Battie, Joseph Peter
Carter, John Michael
Contois, Rita Joanna Maria
Dyck, Gerry James
Eng, Leslie
Graham, Timothy Lee | Hardwicke, David Joseph
Harris, David John
Hut, Victor George
Jadha, Naush
Jambie, Kevin James
Jekeman, David Grantham | Lu, George Chia Hsing
Loadman, Lawrence Gardner
Quan, Isaac
Sieben, Anthony Joseph
Stupen, Peter Michael
Townsend, Bryan Robert | Tubman, Anthony Michael
Wilson, Edwin James
Wong, Eugene Oliver |

1990

CHEMICAL ENGINEERING

| | | | | |
|-------------|---|---|--|---|
| PhD | Englezos, Peter | Jamaluddin, Abul Khar Muhammed | | |
| MSc | Jones, Michael Stuart | Ross, Brian Douglas | Stavroulakis, Dimitrios Angelos | Yang, Guihua |
| MEng | Bergner, Heather Leah
Howell, Stephen Leslie | Mosher, Philip Edward
Stuchly, Michael Jacob | Tzanco, Elena Tatiana | |
| Dipl | Park, Louise | | | |
| BSc | Allford, John David
Anhorn, Todd Lane
Attanwala, Rajpaul Singh
Balycky, Richard Panko
Boyd, Michael Donovan
Codd, Nahia Raja
Codd, Paul Thomas
Colabella, Tony
Dalman, Steven Jon
Deroun, Darryl Stephen
Duggan, Michael John
Fenworn, Kevin Alan
Furber, Mark Stephen
Gang, Anu | Jates, Ian Donald
Grasdal, Carolyn Deann
Hakimattar, Katayoun
Harsch, Ronald Alan
Harper, Scott Lee
Heer, Suzanne Roselea Francine
Henry, James Andrew
Hodgson, Donald Charles
Holmes, Blaine Frederick
Jatrou, John
Iqbal, Sania
Jones, Susan Clark
Kish, Zoe Mane
Koskovich, Timothy Michael | Kowalski, Christopher Bradley
Likusk, Brad Ian
Lothian, James Bryce
Macharia, Maina Augustine
Marchi, Garret Kevin
Marks, Jeffrey Cameron
Mew, Henry Jan
Newman, Kevan Errol
Pilgrim, David William
Poos, Peter William
Rundle, Roderick Clayton
Sandercock, Cheryl Anne
Shephychik, Curtis Peter
Spangelo, James Lloyd | St, Cyr, William Robert
Stewart, Lorraine Alison
Stillwell, Daniel Robert
Tooth, Julie Anne
Trinh, Anthony
Vleck, Sheldon Scott
Wallace, Scott David
Weir, Bryan Dixon
Wissner, Peter Andreas
Wong, Duane Yuk Sang
Wong, Robert
Wong, Samuel
Yang, David Steven |

CIVIL ENGINEERING

| | | | | |
|----------------------------------|---|---|--|---|
| PhD | Bandara, Jayaweera M S J | Kumarage, Kumaragewattage A S | Wijeweera, Harsha | Wu, Ka Hung |
| MSc | Ayoub, Amir Salah E, Din | Mushule, Nuru Khassim | Smyth, Michael William | |
| MEng | Cumen, James Eric | | | |
| Dip | Mayer, Sylvain | | | |
| Dip in Project Management | | Horton, Anthony George | Huang, Tien Chien | |
| BSc | Baglier, Gordon Charles
Brunette, Bruce Michael Patrick
Buck, Christopher James
Chebib, Jim
Choo, Cheng-Kiat
Clapperton, James Archer
Clark, Gordon Thomas James
Clark, Kevin Christopher
Cronk, Mark Van
Curle, Ronald Kevin
Dold, Steven Richard Maximilian
Donnelly, Thomas Michael | Duckworth, Graham Michael
El-Maawy, Abdalla Ali
Finigan, Kelly Ronald
Fletcher, Robert Taro
Goto, Shinji
Greaves, Thomas Howard
Griener, Jeffrey Kent
Grier, Alan Theodore
Hamman, Douglas Mark
Hannah, Robert Craig
Henningsen, Grant Peter
Hui, Richard Wing Shing | Khu, David Daniel Tiampo
Kish, Barnabas
Klisowsky, Donald John
Leung, Tony
Lusella, Joseph
Madden, Timothy Howard
McMillan, James Donald Paul
Mojaphoko, Spencer Mojaphoko
Pasquini, Donato
Pegg, Kurt Allen
Pham, Dong Thanh
Robertson, Glen William | Robertson, Randy Elliot
Samadi, Siamak Moghareb
Schnitzler, Paul Grant
Silvennoinen, Reijo A
Smit, Edwin John Peter
van Weelderden, Floris Iudicus D
vanden Berg, Arthur Lody
Westren, Richard
Whitaker, Charles Eric Foster
Wilson, Robert Warren
Wong, Barry Sean |

ELECTRICAL ENGINEERING

| | | | | |
|-------------|---|--|--|--|
| MSc | Alam, Jasbir
Davies, Robert James
Demers, David Donald
Haddad, Nabil Yacoub | Hui, Tung Pui
Issler, Richard Wayne
Kacelenga, Ray Vivian
Nordquist, Scott Edwin | Shao, Jinqu
Suhura, Michael Joseph
Tarabochia, Jay Paul
Tardiff, Dale Dennis | |
| MEng | Hiltz, Geoffrey Paul | | | |
| Dip | Rao, Veldanda Venkateshwar | Son, Won-Kuk | | |
| BSc | Anthappan, Shino
Apuzzo, Mark David Scott
Arcaga, Victor Immanuel
Astridge, Mark
Barone, Lino
Bartel, Michael Henry
Basher, Curt Nolan
Basu, Ozulkrish
Baudais, Michael Raymond
Belot, Ross Stuart
Bharadwa, Nayan
Bland, Henry Clifford
Bochulak, Dean Jason
Boonsira, Rudolph James
Breeck, Steven Franz
Bundgaard, Douglas Cameron
Chen, Lawrence Kaigi
Chia, Kim Giap
Condon, Robert John | Dirk, Michele Jean
Dymond, Robin Norman
Eng, Kevin Chee Hung
Foltinek, Darren Stuart
Frey, Brendan John
Fritz, Paul Stephen
Gies, David Albert
Gurter, Daniel Barry
Hassam, Karim Shamsu
Hooper, Kevin William
Huculak, Kevin James
Jackson, II, Richard Dennis
Jacobsen, Christopher Robert
Jarratt, Timothy William
Johnson, Timothy Allan
Kim, Thomas Sung-Eun
Kish, Bradley John
Korchinski, Evan Lawrence
Kroon, Henk | Lam, Wan Shing
Le, My Viet
Lee, Wai Ha
Leveille, Ron Benny
Louie, Susan Soo-Ying
Ma, Francis Ka Wa
Mark, Juda Kwok Chun
Mark, Roger Vincent
McAllindon, David Paul
Michaud, Emilia Carla
Mman, Elifuraha
Naderi, Farrokh
Navis, Henry Derk
Neal, Howard Adrian
Nevado, Edmund
Ng, Eddie Tai Chuen
Norris, David Winston
Patton, Edward James
Pham, Jean-Paul | Pocsai, Julius Stephen
Pu, Kok-Meng Dennis
Purhitt, Jitpala Manghar
Pyke, Alvin William
Radulian, Kambiz
Schollen, Hendrik William
Seaman, Michael Allan
Sendyk, Martin Thomas
Sera, Michael Joseph
Sim, Geok Seng
Sood, Adit
Sopczak, Lauralee Mary Therese
Steeves, Teri Lynn
Stopforth, John Wallace
Stroh, Miles Robert
Swaniewicz, Edward Greg
Williamson, Ian Craig
Yu, Dennis Sui Cheung |

MECHANICAL ENGINEERING

| | | | | |
|-------------|--|---|--|---|
| PhD | Fernandes, Luiz Claudio Vieira | Mehta, Sudarshan Arvindbhai | | |
| MSc | Allinger, Todd Lawrence
Grabinski, Piotr | Gunn, Lawrence Arnold
Harris, Kevin Peter | Khanja, Sanjeev Kumar
Speirs, Brian Charles | Springer, Winston Arthur James
Tran, David Viet Dang |
| MEng | Ng, Guan Lee | | | |
| BSc | Ashton, Robert William
Badger, Geoffrey Clark
Baxter, Kevin Cam
Belt, Mark Edward
Berry, Thomas Cecil
Born, Mark Walter
Bors, Trevor Milton
Brooklebank, Wade Joseph
Carrick, Troy Morgan
Cervania, Bienvenido
Chakravorty, Diptendra Kumar
Chorney, Wayne Michael
Christensen, Allan Paul Fris
Collins, Gregory David
Davies, Trevor Andrew | Dick, Kenneth Eric
Dobberthien, David Patrick
Donnachie, James Michael
Eckstein, Mark William
Ferreira, Luis Manuel Moutinho
Garay, Thomas William
Gau, Rodney Anthony
Gibson, Shawn William
Goldsmith, David Frederick
Goy, Michael Andrew
Haki, Shawn Paul
Hamarsnes, Arne
Helm, Jeffrey John
Huitema, Stephan Alexander
Hunter, Douglas Andrew | Huszt, Gavin Charles
Jones, Darren Kenneth
Kesper, Sheldon Boyd
Keenan, David Robert
Lee, Jack
Lindberg, Tams Jili
Lockart, Paul Anthony
Longdo, Blair Roy Vernon
Lye, Hilary Yeung Plau
Mathews, Joseph
McLellan, Bruce
McNeill, David Bruce
Middleton, Wilfrid Charles
Molnar, Sharon Gail
Mulvey, Garth Alexander | Nakazato, Atsuko Christine
Nguy, Nguyen Huu
Nguyen, Lam Thanh
Park, Jamie Allan
Peters, Larry Harold
Peterson, Brian Douglas
Pillich, Vladimir
Piotrowicz, Gregory Michael
Publicover, George Kent
Raeewall, Balaji
Rampi, Shiraz
Rauch, Darrell Wayne
Reaburn, George Stephen
Rust, James Gordon
Sabbagh, Ziad Ahmad |

BSc Sakundia, Gregory Neil
Saponja, Jeffrey Charles
Segouin, Brian Joseph
Singh, Hardeep
Singh, Meera Nand Kaur

Sorensen, Dana Grant
Sorensen, Hans Erik Walter
Springer, Marguerite Julie-Nerine
Thiessen, Richard Mark
Tran, Tai Tan

Vadnai, Leslie John
van Staden, Robert David
Wackerle, Hans John
Walker, Darren George
Watson, Robert John

White, David Mitchell
Yan, Marie Wing Han
Yeomans, George Markland
Zahara, Christopher Allan

SURVEYING ENGINEERING

PhD Knickmeyer, Elfriede Thekla

MSc Stadelmann, Mirjam

Tam, Ashley Pui

MEng Allen, Dianna Elizabeth

Harris, Clyde Bradley

Porter, Todd Russer

BSc Balchen, Bruce Bayne
Chong, Chen Foh
Chong, Sui Yui Leonard
Coelho, Jose Laginha
Cosandier, Darren Duier

Dhalwal, Sukhminder Singh
Fitzner, George
Kocher, Mark Steven
Kwan, Jennie York Jane
Lazorko, Suzanne Gisele Marie

McLeod, John Alexander
Murphy, Gregory Joseph
Natola, Elizabeth Lena
Olson, David John
Osewe, George Ted Otero

Standing, Paul Graham
Tran, Thang
Wong, Hoo Colin
Yeung, David Siu-Ngai

1991

CHEMICAL ENGINEERING

PhD Asif, Mohammad

Gupta, Anup Kumar

Ianaros, Theodoros Ioannis

Tan, Thomas Beng Swee

MSc Bolkan, Yasemin Gulay

Gupta, Subodh Chandra

Negz, Anluan

Salim, Paul Hartawan

MEng Armstrong, Daphne Elizabeth

Will, Robert George

Dip. Jaggard, Randall Thomas

Nasato, Linda verona

BSc Acton, David William James
Amin, Junad
Bano, Shelley Sheliza
Bibault, Kevin Douglas
Carroll, Kevin Spencer
Cawthorn, Joel Drew
Craig, Colin David
Degan, Paul Ivo Dai
Drysdale, Diana Lynn
Eldridge, Mark Philip
Esmail, Naimet Sherali
Forsner, Hali Janine Lana
Fouracres, Scott Charles James Gary
Fowers, Keith William
Goltry, Rajat
Ham, Kevin Michael
Hamid, Arif
Hansen, Vaughn Ashley

Hnatuk, Owen John
Holowach, Nancy Leigh
Holst, Derek Alan
Hong, Samuel Chuan
Hudak, Mark Andrew
Hughes, Randall David
Huq, Ifkhar
Jenkins, Duane John
Kabriel, Chi-Mene vera
Khan, Kashif Alam
Kling, Scott Steven
Knelsen, Shannon Lorraine
Kraft, Preston Blair
Kramer, Cameron Steven
Kuchel, Michael Peter
Langenberger, Catherine Edna
Lee, Dale Francis
Lee, Edward See Pok

Leong, William Wah
Llorco, Francisco Reyes
Jiun, Randy Owen
MacInnes, Kevin Victor Richard
Mallory, Donald Grant
Manuel, Benjamin Pinga
Netzel, David Allan
Nielsen, Bent Bjarnd
O'Neill, Sean Patrick
Odul, Steven Andrew
Poonja, Zahi
Poulos, Nick Christopher
Preece, Michael Douglas
Rae, Derek John
Reding, Darcy George
Rogi, Michael John
Roth, Murray Allan
Santoni, Larry

Sharma, Anita
Siqueira, Susan Anita
Sorensen, Kristine Marie
Stephens, Christopher Martin
Strutt, David Bryan
Ta, Van Thang
Tait, Cheryl Kathleen
Tang, Ying
Thorburn, Lana Frances
virani, Inayat Mohammed
Ward, Mary Jean Esther
Weild, Gregory Edward
Wichert, Gordon Charles
Wickes, Russell Henry
Williams, Peter Elwyn

CIVIL ENGINEERING

PhD Abdelwahab, Walid Mohamad Said

Elgabry, Adel Abdelsalam

Wang, Hong

Weerasekera, Ilsha Ruwan A

MSc Achan, Gopal
Bozic, Ljiljana

Kormann, Jürgen Philipp
Sherif, Aaaa Gamal

Thomas, Joonu Oommen
Wackerle, Erika Marie

MEng Bowlin, Raymond Perry
Grant, Gordon Malcolm

Hall, John Arnold
Patel, Kalpeshkumar Chandubhai

Schaafje, Michael Allan
Wilks, Kevin Gilbert

Dip. in Project Management

Brown, Lawrence
DeHaney, Raleigh

Dhai, Prabir Kumar
Ford, Robert Gordon

MacLeod, Charles Alexander

BSc Armand, Patrice Remi Daniel
Bonertiz, Lorne William
Chiu, Frank
Coad, Wallace Glen
Crowe, Eric John
Davis, Kevin Bernard
Duckworth, Robert Mark
Giacomin, Roger Peter

Hickley, Catriona
Johnston, Ian Kenneth
Kanyawasam, Gaya Saman
Kanyawasam, Shamsani Nileeka
Kerkhoven, Ernst Nicolas
Malmqvist, Lars Lisa
Marika, James Patrick William
McMahon, Stephen William

McNair, Miles Christie Jack
Mickel, Darren Blair
Morgan, Douglas Guy
Mutai, Wilson Kitwale
Phan, Andy
Reeves, Ronald Edward
Reynolds, Susan Dianne
Ryman, John George

Talanco, Robert Joseph
Thompson, David Neil
Tydeman, John Allan
Voronay, Wilfred Allen
Yrkkan, David Randolph Michael
Wang, Sammy Mei Tak
Yuen, Gary Gordon
Yuen, Viola Kwan

ELECTRICAL ENGINEERING

PhD Roy, Sanjoy

Scott, Kenneth Edward

Zeng, Yuming

| | | | | |
|-------------|--|--|---|--|
| MSc | Balasubramanian, Singaravelan
Deng, Tianlin
Goud, Paul Andrew | Heredia, Edwin Arturo
Liu, Bo
Morrow, William Mark | Olasz, Elizabeth Barbara
Tavathia, Sanjeev
Zhang, Hongliang | Zhang, Yuejin |
| MEng | Mangat, Nazar Singh | | | |
| BSc | Andreas, Blair Harvey
Backe, David Shawn
Barnett, Paul Trevor
Beale, Douglas William
Bengessner, Edward Charles
Bodin, Ismail Bin
Chan, Hai Ching Janisian
Cheng, Wai Tai Wilson
Chew, Vincent Nam Seong
Chong, Chiew Loong
Chow, Eric Yeuk
Chui, Ka Wai
Cramer, Seth Whitney
Dang, Hoang Quoc
Dang, Quan Ngoc
de Silva, Roy Amaht
Dermanovic, Ivan
Dilger, Andreas Eric
Driedger, Todd Morris | Durec, Richard John
Eaton, Glenn Howard
Fairbrother, Michael David
Fung, Kenneth Kin Yip
Geeraert, Edmund Patrick
Gibbs, Andrew David
Giann, Barry Wendell
Gopalan, Susheel Kumar
Gulamani, Riyaz Sadrudin
Ho, Brian The Trung
Hoonjan, Rajbir Singh
H Jynh, Kim Hien
Jin, David Higgin
Kahsai, Tsehaw Zere
Kramer, Hermann
Kulach, Christopher John
Kwok, Jackie Kiu Lap
Lam, Galen Ka-Ron
Lam, Roodie Kwok Chuen | Leclerc, Shelley Dawn
Lee, Raymond Yoh-Hoe
Lever, Craig Michael
Liu, Ryan Kwong Yuen
Ma, Cheong-Chor
Ma, Kenny
McConachie, Kenneth David
McCormick, James Patrick
Mok, Irene Ying-Wai
Morris, Rodney Dean
Narayanasamy, Ramesh
Nguyen, Quang Manh
Odum, John William
Phillips, Scott Laurence
Schluff, Monique Vivian
Shoham, Idan
Sines, Stephen John
Smith, Gregory Warren
Smith, Lorne Michael | Spelren, Gerald Alvin
Thomas, Michael David
Thornburt, Todd Mar-
To, Brian
Tong, Man San Susan Mary
Tran, Nhen
Tran, Thinh Quoc
Tu, Dung Hoa
van de Sande, Robert Johan
vinces, Karim Pyarali
Yu, Dennis Thong-Khanh
vuong, Hai Ngoc
Warner, Colwyn Enfield
Weder, Eric Albert
Wekel, Trevor Stewart
Wirtzfeld, Michael Roy
Yeung, Pak Keung Walter
Zaman, Selim Uz |

MECHANICAL ENGINEERING

| | | | | |
|-------------|---|--|--|--|
| PhD | Bugg, James Donald
Jameel, Mohamed Ishaq | Mowinka, Jaroslaw
Qiu, Xiang Yao | Wierzb, Pawel | |
| MSc | Kar, Krishnendu | Nase, Per Ivar | Rainville, Pierre | |
| MEng | Feighan, Patrick Joseph | Patching, Richard George | | |
| BSc | Afonso, Olav Antonio
Bailey, Daryl Gordon
Barge, John Ross
Beli, Murray Milton Carlson
Berd, Daniel Gregory
Bowes, Patrick David
Chan, Mankit
Chipchase, Janis Hanna Mae
Chorei, Jeffrey Wayne
Colhoun, Sielan Claus
Collins, Rodney Douglas Grey
Corner, Christopher Todd
Cozens, William Dale
De Rosa, Paolo
DeMaio, Stephen Joseph | DiFlumen, Giuseppe Aldo
Donnelly, Sandra Lynn
Dustin, Cameron Dean
Eckford, Donald James
Engler, Katie Susan
Frison, Alan Thomas
Hoshizaki, Vernon Frank
Hoven, Peter Darren
Kaba, Karim Noorali
Kalivoda, Richard
Kedge, Christopher James
Knopp, Douglas
Kreit, Cameron Scott
Kwan, Alvin Tak Leung
Livanichuk, Allan Walter | Mahler, Marcus Leo
Martindale, Timothy Holme
McQuattle, Andrew
Mercier, Thomas Christopher Ryan
Milner, Bruce Andrew
Ngai, Lawrence Nani Sing
Nisholson, Alan Kirby
Pankiw, Apollinaria
Patton, George Vanier
Pilane, Bennett
Rasmussen, Kevin Lenard
Rath, Kenneth Shane
Roesinger, Stephen
Rosenvall, David Lynn
Sadler, Andrew Martin | Sahney, Reena
Sanderson, David Murray
Schober, Christopher Edwin
Schotanus, Scott Trevor
Smith, Alex Neil
Stewart, James Herbert
Symmes, Matthew Lee
Thong, Chea Yen
Jensenbach, Andrew Wayne
Wabischewich, Walter Bill
Wilton-Clerk, Harry James
Wohli, Gregory Robert |

SURVEYING ENGINEERING

| | | | | |
|-------------|--|--|---|--------------------------------------|
| PhD | Bayly, Donald Andrew | Cannon, Margaret Elizabeth | | |
| MSc | Lam, Wai Keung
Lapucha, Danusz Ryszard | Lu, Gang
Martell, Hugh Ear | Schultz, Fern Marie | |
| MEng | Johnson, Jill Renee | Seguin-Allan, Francis Edward | Speakman, Timothy Edward | Wong, Kenneth Wing Yan |
| BSc | Andrews, Richard Pierre
Chan, Flora Fung Ye
Di Giovanni, Rudy Leonard
Fuss, Brian Charles
Gill, Arthur | Hare, Robert Mason
Hawinkels, Sandra Michelle
Hoogstraal, Michael John
Hume, Andrew James
Jeschke, Colin Brian | Lam, Son Ngor
Joyd, Ian Michael
Miles, Gordon Derek
Pham, Allan Tuan
Sharpe, James Calvin | Szabo, Douglas James
Zizka, Radim |

1992

CHEMICAL ENGINEERING

| | | | | |
|-------------|--|--------------------------------------|---|---------------------------------------|
| PhD | Forestell, Sean Patrick | | | |
| MSc | Anhorn, Jodi Lane
Eddy, Derry Burton
Feeworn, Kevin Alan | Gomez, Pablo Andrés
Gupta, Aparna | Krishnan, Mani
Liebe, Haraki Randall | Pugsley, Todd Stewart
Wong, Robert |
| MEng | Ireland, Frederick Brian | Low, Granger James | Sheritt, Richard George | Jensenbach, Matthew Gerald |

Dipl Knowles, Dale Peter

BSc Anderson, Cheryl Marie
Ashton, Douglas Scott
Bergey, Gordon Alexander
Borjas, Wayne Michael
Bowman, Robert Reid
Bratrud, Thomas Buckley
Brown, Todd McRay
Chernichen, Jeffrey William
Chowdhury, Mini
Daibbs, Michael William
Doney, Nina Gyaltsen
Everett, Gregory James
Graham-Navis, Heather Lynn
Gupta, Suneel Krishan

Hegold, Mark Lorne
Holoboff, James Lowell
Homayouni, Saeed
Hughes, Bret Alexander
Johnson, Christoph Jamon
Karwacki, Robert Daniel
Koster, Eden Cornelia
Lange, Tomasz
Lupick, Gregory Stephen
Ma, Kuan
Magus, Jeffrey Colin
McNeill, Terry Lee
Motamedi, Ehsanollah

Nociar, Bruce Allan
Nurani, Asin Laji
Okumura, Howard Arthur
Piomp, Lauren Elizabeth
Radons, Michelle Rowena
Reynolds, Maria Alicia
Robertson, Christine Ann
Ryan, Mark Patrick
Sadler, Michael James
Shanna, Anita
Smith, Steven Patrick
Sterling, James Cory
Supanov, Josko

Taiwar, Ankur Ramesh
Tom, Norman Chun Hing
Trinh, Howard Hao Van
Wadsworth, Richard Alan
Wansleben, Monica
Waterman, Darren Michael
Wilkinson, Stacey Lee
Williams, Daniel Barclay
Wilson, Darryl John
Wilson, Jeffrey Todd
Yanicki, Gregory Robert
Yee, Donald
Young, Bradley James

CIVIL ENGINEERING

PhD Chang, Chladih

Simbeya, Kazombwa Wycliff

van Der Voet, Adrian Frank

Xu, Changshi

MSc Alkad-Salam, Mohiddine Ali
El-Maawy, Abdalla Ali

Kumaraguru, Pennakaruppan
Lin, Zihui

McGinn, Donald Joseph

Schade, Jürgen Emanuel

MEng Beattie, William John
Bergman, William Joseph

Carnduff, Richard Donald
Carrasco, Milton Santano Elias

Ghali, Maged
Luk, William Yu-Lum

Simpson, Edwin Robert
Smith, John Michael

Dipl Kowalczyk, Stefan

Dipl n Project Management

Khazanavicius, Danilius
MacKenzie, Gordon Bruce

Maidment, Peter Edward
McCargai, Murray Coulson

Miller, Robert Percy
Perrin, Daniel Ernest

BSc Akbari, Sahba
Alicantara, Joey Dennis
Barrow, Vivian Nicole
Boonstra, Mark Gordon
Bornemisza, Susan Ann
Brown, Simon James
Buzunis, Byron James
Da Silva, Antony David

Dunn, Bradley James
Finley, Kirby Clark
Hia, Long Phi
Hianeri, Alana Dawn
Hanevy, Paul Laurence
Kerr, William Barclay
Kosik, Wayne Stephen

Lee, David Duport
Legary, Ryan James Edward
Louie, Richard
Ma, Pele Man Chun
MacKinnon, James Scott
McLean, Andrew Bruce
Mooney, John David

O'Sullivan, Sean Patrick
Posada-Flaherty, Norma Estela
Ranks, Marc Richard
Sam, Steve Toan-Quoc
Sempie, Cheryl Ann
Seto, Chun Hung
Smit, Craig Matthew

ELECTRICAL ENGINEERING

PhD Kuduvali, Gopinath Ramaswaramiah

MSc Eng, Kevin Chee Hung
Gordon, Cecil Edgar
Joshi, Shashidhar Ram
McGibney, Grant Howard

Morrison, Gerald Dale
Morshed, Ahmed Hisham
Nagalla, Radhakrishna

Qin, Jichang
Shen, Jiang
Tamrakar, Indraman

Williamson, Ian Craig
Yousif, Abdel-Fattah Sayed
Xie, Jingping

MEng Shaw, Dwayne Erik

Zwierchowski, Stanley John

BSc Akrit, Trevor Mitchell
Baker, David Andrew
Bakoway, Colin Frederick
Balcewicz, Anthony Edward
Barker, Ian Wesley Scott
Baudais, Brian Gustave
Blankenstein, Bert
Borsodi, Thomas Patrick
Chamoun, Fadi
Chan, Peter Doug Sing
Chhuor, Shane Siv Ang
Chin, Shi Kwong
Choi, Ricky Yiu-Kee
Chou, Van Man On
Chow, Kenneth Siu-Kin
Collins, Susan Marie
Dang, Hiep Hong
Dionne, Jason Dennis
Dumont, Lisa Rae
Esau, Leslie Duane

Felix, Peter John
Fisher, Arthur John
Foo, Sek Phuen
Foster, Catherine Elaine
Goossens, Roger Alexander
Huen, Matilda Sherman
Jansma, Aaron Rex
Jayasekera, Gebalanage Manohara P
Kalanian, Tamilselvam
Kheng, Oon Hui Samuel
Koo, Marco Chi Wa
Lacey, Kendal Alan
Lai, Yun Tai
Lair, Bradley John
Latani, Nooridin Badrudin
Lam, Clinton Leung
Lam, Daren
Lau, Christopher Yiu Kee
Lee, Cheng San
Lee, Chong Han

Lepa, Paul Gregory
Lo-Chun Ah, Patrick Allen
Loh, Michael Eric
Long, Kelly Diane
MacPherson, David Allan
Mitchell, Bernard Thomas
Moghaddami, Khosrow
Moosa, Alaziz
Muscoby, Gregory Brent
Nguyen, Dong Phu
Nguyen, Hoa Phu
Nguyen, Tam Huu
Oh, Jung-Hwa Jenny
Olekshy, Michael Melvin
Or, William Bradley
Ostalichuk, Ronald John
Osvath, Charlotte Idikó
Paarsmarkt, James Benjamin
Parekh, Kishor
Parker, Robert Arthur

Parks, Richard Gordon Joseph
Patton, Mark Ashley
Popowich, Ronald Vladimir
Rao, Kolar Prabhakar Anand
Rolsion, William Alexander
Schieb, Grant James
Shykula, David Peter
Slingerland, Darryl
Smit, Dick
Smith, Dallas Richard
Stetner, Anton John
Toh, Allan Kim-Pheng
Ung, Yeng Kai Patrick
vervoort, Richard William
vonkeman, Albert Laurens
Vuong, Mike C
Williams, Barry Douglas
Wittiger, Klaus-Dieter Vinzenz
Wong, Raymond
Yamada, William Alan

MECHANICAL ENGINEERING

PhD Anton, Michael Gottfried

MSc Caswell, Darryl John
Lee, Yong Gyu

Potter, Ian James

Zhang, Yan Xiu

Zhao, Wuyi

MEng Klotz, Gerard Theodore Arthur

Yi, Sang

BSc Bergman, Joseph William
Bertrand, Scott Duane
Bessam, Barbara Louise
Chui, Jonathan
Clavette, Eric John
Collins, Daren Nicholas
Conran, Andrew William
Corner, Kenneth John
Corti, Stefano
Curran, Darren Ashley
Deucher, Gregory Walter
Galinsky, Gary
Gamble, Dennis Hayes
Gaucher, Michelle Louise
Giacomin, Steven James
Gidlot, Calvin David
Harit, Christopher Allan
Heidecker, Ivan Dean

Ivers, Philip Andrew
Jacques, Peter Alan
Karwacki, Murray Gerald
Kernick, Brian Robert
Knott, Christopher Norman
Kohut, Tyler Wayne
Kondics, David John
Korczewski, Christopher
Kostashuk, Elizabeth Joan
Krehmer, Jeff Gottfried Jdo
Lawrence, Thomas William Austin
Lee, Dixon Kam Lung
Lee, Rudy Hin
Leeds, Brenda Merran
Liebe, Markus Norman
Littlewood, Allen Neil
Loon, Wing Pang

Lyseng, Darren Glenn
Mathieson, Stacy James
Miciak, Piotr Adam
Millord, Rodney David
Nichols, Stewart Alexander
Nicholson, Ian Michael
Nikiforuk, Kenneth Alan
Nodwell, Keith Andrew
Raftaub, Kurt Samuel
Robinson, Frederick Joseph
Rossiter, David Michael
Sanchez, Ian
Sauer, Timothy Allan
Sawa, Mark Robert
Sharp, Leeanne Marie
Shilmover, Barry Baruch
Staler, David Jonathan

Smolka, Robert Steven
Spropoulos, Theophanis Constantinos
Sternberg, David Jordan
Stevenson, Amy Joy
Thompson, Steven
Vandervliet, Antony Derrick Eaton
Vaceer, Tabraiz Bin-Ahmed
Victor, Anthony Joseph
Wagner, Troy Trevor
Wegmann, Kurt William
Webow, Ronald
Wilks, Dwayne Sheldon
Williams, Daniel Neale
Yates, Maureen Ellen
Yee, David Edward
Yee, Raymond Yuen-Sing
Zboya, Douglas Craig

SURVEYING ENGINEERING (renamed GEOMATICS ENGINEERING)

PhD Karimi, Hassan-Ali

MSc Erickson, Caroline Anne

Lam, Sau Mui Sylvia

Liu, Zhen

Miller, Ross Geoffrey

MEng McLellan, James Frederick

BSc Banham, Geoffrey Lawrence
Carbognin, Andrew
Dawkin, Leonard Charles
Denby, Neil Raymond
Drake, Bruce Michael
Dumka, Markian Ivo
Farshon, Farhan Sharique

Gahuna, Kanwaljit Kaur
Gehus, Hazen Leslie
Hinkelman, Jill Patricia
Hoang, Dai
Hobbs, Geoffrey Michael
Hockley, Dallas Clifford

Kent, Stephen Craig
Lantz, Donald
Lee, Kwok Leung Louis
Nguy, An Tay
Parkin, David William
Roesnes, Richard Dale

Rutherford, Douglas Jim
Srajer, Peter Jonathan
Sukup, Marcel
Westlake, Ian John
Wong, Kin
Yu, Shuk Choi Sylvia

1993

CHEMICAL ENGINEERING

PhD Tan, Zhimin

MSc Ersan, Otko
Farrell, Patrick James
Hawboldt, Kelly Anne
Kanakia, Vivek
Kowalski, Christopher Bradley

Mazumder, Prantik
Nielsen, Bent Bjarno
Parent, John Scott
Pecher, Radek

Saha, Chandreyee
Saha, Samit
Sanikop, Banu
Shah, Pushkar

Sood, Arun
Tatarenko, Pamela Karen
Tse, Cecilia Wai-kam
Win, Than

MEng Chow, Louis Shun-Shing
Dunn, Richard James

Henry, James Andrew
Kenny, Joseph

McAuley, Claire Mary
Moore, Bernard Jerome

Nasato, Linda Verona
Serhai, Kamal Elias

BSc Baker, Christopher Paul
Blair, Percy Robert
Bulat, Daren Andrew
Chan, Wai Kheong
Chelico, Alexander Basil
Choo, Suet-ling
Choong, Yeow Lim
Chowdhury, Tarekul Amin
Cunningham, Donald

Driscoll, Ian David
Farkas, Raymond Francis
Fookes, Robert Bradley
Garden, John Robson
Gordon, Scott Anders
Guirguis, Adel Samir
Immer, Daniel
Kaethier, Paul Elliot
Kobylika, Leo Cervenka

Kostiuk, Kelly Jason Todd
Lawrence, Timothy Andrew
Lut, Linh Thieu
McAuley, Robert Lewis
McNabb, Sandy Allan
Nguyen, Dieu Khanh
Piché, Ross Patrick
Platon, Rowena Andres
Pratt, Vanessa Francesa

Prokopiuk, Kelley Nicole
Puchyr, David Michael John
Sobh, Mahmoud Ahmad
Sodero, Sean Francesco
Steeves, James Kenneth
Steinicke, Anthony Otto Salvatore
Teigen, Lora Lee
Wells, Diane Lucille
Young, Cecil Keng Hon

CIVIL ENGINEERING

PhD Fang, Yingwu
Li, Yonghong

Painak, Anil Kumar
Shi, Cailun

Sirosh, Sadanandan Neelambri

Wang, Naisong

MSc Ariyawardena, Nihal Thilaka M D
Archila, Adrian Ricardo
Cao, Hongjie
Chimich, Dennis David

Chui, Jo-Jimmy Chi-Yin
Coffin, Ann Maureen
Dada, Ezekiel Sunday

Hammill, Neil Lamont
Owoc, Malgorzata
Pan, Xuefang

Samaan, Michel Sabri
Talarico, Robert Joseph
Weng, Kaimao

MEng Costello, Nigel Geoffrey Shaun
Kassam, Mansur

Lyzanivski, Michael John
Mayell, Larry John Vincent

McWhinnie, Cunningham Thomson

Nightingale, Peter Russell John

Dip n Project Management

Bridgett, Robert Fraser
Kowalczyk, Stefan

Prince, Geoffrey Frederick

Valenzuela, Victor Hugo

| | | | | |
|------------|--|--|---|--|
| BSc | Balasch, Aaron Joseph
Burnell, Stephen John
Chan, Flora Fung Ye
Finley, Ryan Glen Boyd
Golightly, Russell Roy
Grant, James William
Greer, Michael Shane
Haas, David James | Haggart, Kevin Charles
Hammer, Tracy Ann
Harty, Darryl Mark
Hayden, Michael Tryggvi
Henderson, Michael James
Knapp, Noel Grant
Knopp, Glen Darren
Kohler, Richard Ralph | Lebe, Theresa Michelle
Mason, Darren Craig
Massé, Kenneth Gordon
Merali, Azizudin Sadrudin
Newman, Shane Irving
Park, Rodney Colin
Paviglianiti, Giuseppe Antonio
Predika, Raymond Stephen | Ro, Thomas Jai Young
Sauve, Jason Kenneth
Scoble, Kevin Andrew
Shuhaiber, Rony AM
Stokes, Tyrone Perry
Tewnlion, Angus Jameson
Tolley, Christopher John
Walters, Dale Alvin |
|------------|--|--|---|--|

ELECTRICAL ENGINEERING

| | | | | |
|-------------|---|--|---|--|
| PhD | Boutefellal, Djamel
Gilany, Mahmoud Ibrahim | Knudsen, Knud Steven | Yang, Ming | Zhang, Yuejin |
| MSc | Chia, Kim Giap
Douglas, Mark Gordon
Fan, Xiaohua
Gibson, Andrew Frankel
Jin, David Higgin
Johnston, Bruce Alan | Klukas, Richard Walter
Li, Ningdong
Liu, Ying
Moussavi, Zahra Manan Kazem
Patton, Edward James
Provine, Joseph Arujaganatharaj | Rabie, Tamer Farouk
Shoham, Idan
Shu, Zhi-Ming
Smith, Lorne Michael
Wang, Yun | Worthington, Stephen David
Wu, Qiong
Yang, Jie
Yang, Lili
Zhang, Penggang |
| MEng | Donaldson, Brian Paul | Hou, Bing Lin | McRory, John Godfrey | Nguyen, Hieu Ngoc |
| BSc | Anklovitch, Darrell James
Bacanek, Zeljko
Basboll, Morten
Borsodi, Andrew Louis
Burger, Michael Curtis
Cavanagh, Steven Peter
Chamberlain, Robert James
Chan, Kok Fai
Chan, Terrence Chi Hang
Chan, Yu Vincent
Chang, Aik Hui
Charters, William David
Cheong, Yik Lok
Cheung, David Wai Keung
Chew, Siaw Peck
Chik, Chi Ping
Chui, Kenneth Chun-Sau
Chui, Wai Ching
Chung, Chia-Luh
Cochrane, Bruce Carlton
Cole, Kenneth Barry | Lowle, Daryl Stewart
Dang, Dung Ngoc
El-Kadiki, Salahuddin
Ellefson, Thomas Allan
Frede, Michael Andrew
Gall, Warren Edward
Ghanduri, Hussein
Higgins, Catherine Mary
Hilger, Aaron Michael
Ho, Khai Sing
Ho, William Tai
Hua, Michael Nghia
Huber, Gregory James
Jackson, Scott Randall
Juma, Shamir Rasul
Kartushyn, Dale Allan
Kelly, Shaun Patrick
Kim, Kathy Hmi
Kneller, Geoffrey Rodney
Kularatna, Adikange Shavanitha A | Lee, Darren Robert
Mah, Marvin
Maves, Franklin Donald
McLean, Andrew Kelly
Mitenko, Peter Francis
Muszynski, Bartolomiej
Nisar, Mustafa
Nummohamed, Mehmood S
Phung, Cuong Duc
Po, Corrina Yuk Mei
Quintana, Mauricio
Rablaff, Saskia
Ritter, Paul Owen
Roberts, Mark Andrew
Shewchuk, Frank William
Shim, Earle Norman
Siemens, Wendall Lee
Singh, Manjit
Smith, Michael John
Sokolosky, Jason Conrad | Stagg, Keith Andrew
Stenseth, Owen Curtis
Tan, Wee Ming
Tang, Kai Hung
Tang, Ying Pang
Taylor, Daniel Cameron
Teo, Soon Eng
Teoh, Eugene Tai Heng
Tong, Eric Man Leung
Tse, Kenny
Turner, Carl Sidney
vigor, Patrick Michael
vinogradov, Mark
White, Calvin Douglas
Wong, Bernard Chung Sze
Wong, Wai Keung Wilkie
Yau, Jim Chi-Luen
Yue, Timothy Wai Man
Zeng, Xiaojing
Ziólkowski, Rodney David |

MECHANICAL ENGINEERING

| | | | | |
|-------------|--|--|---|---|
| PhD | Gao, Jing
Huang, Hongsheng | Huang, Xiaolin
Kwok, Alvin Daling | Zheng, Ming | Zhou, Guangguo |
| MSc | Chen, Heli
Khellil, Emad Boshra Fawzy
Kumar, Ajay | Mathews, Joseph
Oladipo, Adedeyo Bukola | Rao, Harish Ananda
Shrestha, Shiva Om Bade | Tang, Shao-Shan
Yin, Frank Yangqi |
| MEng | Ang, Elin Dy | Fung, Adrian Kui-Fai | Hu, You-Lin | Varughese, Kunju Kunju |
| BSc | Albush, Larry Warren
Stasiak, Arieta Urszula Arasna
Ashta, Negussie Gebremariam
Barton, Kean Donald
Besserer, Michael Geoffrey
Boyer, Douglas Keith
Butterworth, Eyon Graeme
Chappell, Thomas Lee
Cook, Curtis Michael William
Corli, Simon
Cumberland, Roland Raymond
Cusanelli, Serafino Roberto
Darby, Craig Ian
Dayoub, Yasser Ali
Deaver, Melissa Gail
DeCuyper, Marc Edward | Doan, Duy Khuong Huu
Fowers, James Ian
Fraser, Charles Francis
Graham, Vance Murray Teasdale
Haka, Kevin Scott
Herda, Myles Michael
Hoar, Stacey Anne
Jelinski, Glenn Donald
Kappelhoff, Mark Andrew
Klein, Jonathan Francis
Kondo, Blaine Donald
Lawrence, Dennis Malcolm
Laong, Art
Litorco, Hector
Machacek, Todd Jacob | McKechnie, Neil Murray
McKenzie, Douglas Neil James
McPike, Timothy Peter
Metzinger, Robert Gerald
Miller, Carl John
Mis, Waldemar
Mortimer, Spencer Kelly
Naidu, Ethirajulu Balakrishnan
Papanikolaou, Nancy
Poh, Heon Khoo
Robinson, Brady Edward
Sawyer, Toby Gay
Scott, Stephen Frederic
Slapek, Maciej Mar
Sorensen, Ene | Soutar, Scott Frederic
Stowell, Craig Robert
Tremaine, Darren Paul
Tunney, Barry Edwin
Turvey, Michelle Diane
Jrsenbach, Daniel Octave
visser, Mitchell Dean
Waters, Timothy James
Webb, Steven Douglas
Wells, Bradley Gordon
Will, Carter Lewis
Willson, Trevor Ewen
Wong, Terry Kinfun
Woo, Danny
Yuen, Glenn Gee |

SURVEYING ENGINEERING (renamed GEOMATICS ENGINEERING)

| | | | | |
|------------|--|---|-------------------------------------|---------------------------------------|
| PhD | Gao, Yang | Rauhut, Angela Christine | Sudibjo, Ely Rasdiani | |
| MSc | Abousalem, Mohamed Atba
Alai, John Ayoo
Al-Hanbali, Nedaj Maim | Fuss, Brian Charles
Kornett, Solomon Kipruto | Li, Yecai
Obidowski, Ray Michael | Robbins, Paul Anthony
Sha, Bin Bin |

| | | | | |
|-------------|--|---|---|---|
| MEng | Warford, Robert Louis | | | |
| BSc | Brooks, James Scott
Bullock, James Blake
Chiasson, Charles Lewis
Desrochers, Marc Aubrey Todd | Haub, Duane Murray
Ionescu, Cristian George
Joerissen, Daniel James
Lau, Kam Tim | Lovse, John William
MacDonald, Gordon Robert
Pollard, Robert Brad
Robertson, Ian Roy | Schulz, Glenn Dieter
Sydonuk, Peter Andrew
Tam, Rickie Yui Cheung |



a The Electrical Engineering Department's Open House Display in the Student Lounge is manned by Jen Bruton (R) and Jim Hastett with Pat Walsh visiting the display



b Dick Stein (R EE) and A. Torvi (ME) taking a coffee break in the Student Lounge

Plate R — The Silver Anniversary Open House - Oct. 17-19, 1991.

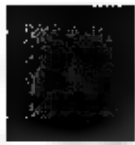


a A student fun activity during Engineering Week, called Queen Week prior to 1990 is the annual toboggan race referred to as Winter Festival. It is held on the eastern slope of the St. Andrew's Heights hill, just south of 16th Ave. NW and west of University Drive. Teams consisting of four members enter the competition to achieve the lowest total time and win the ESS prize. Start of the race is at the base of the slope from which three members of the team pull their sled with the fourth member on top up the hill to the turn-around line at the crest. All four ride the toboggan on the way down to finish at the starting line. Teams from each Department and from the 1st and 2nd year students' FSVES, historically compete in the event. View towards ENE with University Drive running at the base of the hill and the Trans Canada Hwy appearing in the upper left of the photograph.



b The team running team wearing 1990 FSVES costumes (despite an all-out effort, their identity could not be determined) are nearing the turn-around line. Could their lead at least partially be due to the fact that they lost their passenger on the steep, icy part of the slope? The competitiveness of the event is evident from the effort exerted by members of the team. View towards NW.

Plate S — Engineering Week's Winter Festival activities - Tuesday, Jan. 16, 1990



The University's official colors: green, gold, red and black.



The first U of C logo was designed in 1966 and was in general use until 1980. It features three of the institution's official colors through which it symbolizes two of Alberta's main industries and Calgary's red Chinook skies.



The coat of arms was granted in 1966 by the Lord Lyon King of Arms in Edinburgh. The official motto of the institution, also adopted in 1966, reads, in Gaelic:

Mo shuile togam suas; - I will lift up my eyes



The current official logo of The U of C was designed in 1980 and has been in use since then on all university stationery and publications.

Plate T — The U of C's colors and symbols



Plate U — View of the Engineering Complex at The U of T, View towards East, 1984

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